Scope: The Modeling Plan will provide a list of activities to model the current and future performance of the CSS as it relates to the National CSO Policy and Christina TMDL. The plan will include approaches to modeling Final LTCP elements such as green infrastructure, new priority projects, and sewer separation.

Status: The City (through its consultants) has completed modeling in one of the five interceptor sewersheds, and flow modeling development has begun in two of the remaining four sewersheds. The City is currently working on a plan to complete the remaining flow modeling work within the permit period

P4– Develop Final LTCP Benchmark/Baseline for CSO Discharges & Reprioritization of Outfalls

Deliverable: A report providing the benchmark of the current CSO discharges and CSS performance due to completion of the ELTCP including prioritization of CSO outfalls based on their compliance with required TMDL loads, discharge volume, and discharge frequency.

Deadline: October 1, 2017

Scope: The prior ELTCP projects were developed based on addressing certain priority outfalls. However, in order to prioritize future projects and initiatives in the Final LTCP, the current CSS performance and CSO discharges require a new post ELTCP completion benchmark established. The outputs from the benchmarking effort may result in the reprioritization of CSO outfalls based on a number of factors such as TMDL load compliance, CSO discharge volume, and CSO discharge frequency.

Status: The development of the CSO and CSS performance benchmarking report is currently being evaluated and planned. This activity is dependent upon the implementation and optimization of the RTC and 11th St Pump Station and item #6 from the permit. Once these are complete then a new benchmark and outfalls can be reprioritized.

3. NINE MINIMUM CONTROLS (NMC)

3.1. NMC APPROACH OVERVIEW

This report documents the City of Wilmington's CSO program activities during calendar year 2014, and provides qualitative and quantitative data on performance measures. This report addresses each of the Nine Minimum Controls (NMCs).

The NMC controls are based on the EPA's Guidance for Combined Sewer Overflows (CSOs): Nine Minimum Controls, EPA 832-B-95-003, dated May 1995.

3.2. NMC CSO OBJECTIVES

The objectives of the Nine Minimum Controls are the following:

To reduce CSOs and their effects on receiving waters
To reduce CSOs and their effects on receiving water quality
To be controls that do not require significant engineering studies or major construction
Can be implemented in a relatively short period of time

3.3. **NMC #1** CONDUCT PROPER OPERATIONS AND REGULAR MAINTENANCE PROGRAMS

PURPOSE

To reduce the magnitude, frequency and duration of wet weather CSOs and to prevent dry weather CSOs by enabling existing facilities to perform as effectively as possible by continuing to implement the Operations and Maintenance plan for the combined sewer system (CSS), update the Plan to incorporate any changes to the system, and operate and maintain the system according to the Plan. Keep records to document the implementation of the Plan.

ACTIVITIES

The designated manager for the CSS is the Environmental Program Manager for the City of Wilmington- Public Works. This person is responsible for the wastewater collection system and serves as the contact person regarding the CSS.

All operation and maintenance of the CSS system is done consistent with the City's CSS Operation and Maintenance Plan revised July 2004 and the City of Wilmington CSO/RTC Operations & Maintenance Service Proposal by VWNA LLC July 1, 2011. All CSO structures, regulators, pumping stations, and tide gates are inspected and maintained to ensure they are in good working condition and adjusted to minimize CSOs and prevent tidal inflow. Implementation of the plan is documented via daily inspection logs, see Figure 3-1 for a sample log sheet.

Figure 3-1 Daily Inspection Log

City of Wilmington Department of Public Works CSO Inspection and Maintenance Log Sheet

Inspection Date: ______________ Insp. Personnel: ______________________________

Weather: Temperature:

CSO ID#	Location	Inspection Time	Regulator/Diversion Inspected	Outfall Inspected	Overflow Observed	Signs Y or N	Comments
SPC	Delmarva						
2	12 st P.S.						
3	11 st P.S.						
4A	Foot of Locust						
4B	Foot of Church						
31	35th and Bowers						
20	Kirkwood Park						
21A	Kirkwood Park 2						
21B	Foot of Pine						
18	Foot of 9th st						
19	Foot of 10th st						
Tidegate	East 8th st						
Tidegate	West 8th st						
16	Noramco West						
17	Siphon at Wilson ln						
9C	Lobdell and Bradford						
9A	Christiana and Claymont						
9B	Christiana siphon						
10	A st at Locust						
Tidegate	A st Locust and Market						

CSOs in high priority or sensitive areas are inspected daily, the remainder of the CSOs are inspected 3 times per week. Maintenance demands, particularly during wet weather, may preclude strict adherence to the schedule at all times, however, each CSO is inspected at least once a week. Inspections procedures are as follows:

- Inspect regulators (including diversion manholes) for any observed flow (wet or dry), debris, blockages and damage, remove any debris found. Enter structure if necessary.
- Visual observation of outfalls and any overflow observed (wet or dry). If flow is observed, inspect the regulator for debris or blockage. Check that CSO warning signs are in place.
- Inspect tide gates and remove any debris observed to be preventing proper operation of gate.
- Record inspections in the daily inspection log and log into database.

Special inspection procedures are as follows:

- CSO 27 – check and clean trash rack upstream of regulator
- CSO 28/29 – perform inspections and maintenance as outlined in the Canby Park Retention Tank O&M Manual
- CSO 30 – inspect control gates and weirs, remove debris

See section 3.7 **NMC #5** Prohibit Combined Sewer Overflows During Dry Weather, for dry weather overflow information. See Table 3-1and Table 3-2 below for inspection information.

Table 3-1 Summary of CSO Inspections Performed in 2014

CSO Location	CSO ID	Number of Inspections
12 St. PS	2	320
11th St. PS N. Side River	3	352
Foot of Locust	4a	381
Foot of Church (DM @ Pine & 26th)	4b	387
Jessup near 16th St. Bridge	4c	292
Race & Hutton St.	4d	376
17th & Glen Ave.	4e	378
Foot Wash. St. Bridge	4f	229
Foot of Orange	5	234
Foot of Shipley	6	234
Foot of Market	7	235
E. Side 4th Street Bridge	9a	384
Christiana Siphon	9b	102
Lobdell & Bradford	9c	301
A Street at Locust	10	384
Foot King & Water	11	235
Foot French & Water	12	235
Foot Lombard & Front	13	234
Front & Church	14	234
Foot Front & Church N. side of river	15	234

CSO Location	CSO ID	Number of Inspections
City Fire Boat Dock	16	235
Inside Siphon @ Wilson Line	17	235
Foot of 9th S. Side River	18	387
Foot of 10th S. Side River	19	387
Kirkwood Park	20	238
Kirkwood Park 2	21a	238
Foot of Pine	21b	238
Foot of 14th S. Side of River	21c	291
Foot of Walnut	22b	378
Foot of King (DM @ King and Race)	22c	228
Foot of West & Park Dr.	23	297
Foot of Adams St.	23a	231
Foot of Jackson & Park Dr.	24	231
Rattlesnake Run	25	380
Elliot Run	26	378
Lancaster & Webb	27	383
Grant & Rodman	28	383
Canby Park	29	382
Madison St. Conectiv Yard	30	235
35th & Bowers (DM @ Eastlawn & GP Blvd.)	31	238
Kentmere and Union	KU	232
Foot of Rockford Rd.	RR	298

Table 3-2 Summary of Tide Gate and Other Structures Inspections Performed in 2014

Structure and Location	Tide Gate ID	Number of Inspections
Tide gate - N. Side E. 8th E. Side Wilm. Ind. Park	U01	252
90 degree bend - Foot Poplar & Front	U02	250
Tide gate - A St. between Poplar & Lombard	U03	252
Outfall only - W. Market St. Brdg. S. Side of River	U04	238
Tide gate - C St. W. of Market @ River	U05	238
Tide gate - F St. W. of Market @ River	U06	238
Tide gate - E. of RR Bridge S. Side River	U09	238
Tide gate - N. Side E. 8th W. Side Wilm. Ind. Park	U10	252
Tide gate - Shellpot	U15	148
Tide gate - W. of RR Bridge S. Side River	U20	237

During the course of the inspections performed at the CSO locations, a total of 1,990 lbs of debris was captured and removed from Lancaster and Webb St. (CSO 27) prior to reaching the receiving waters.

Remote monitoring of overflows at CSOs 4A, 17, 19, 25, 30 occurred daily throughout 2014. Monitoring results indicate no overflows at CSOs 17 and 19. The most active overflow sites were CSO 4A with a total overflow duration of 208.9 hours, and CSO 29 with a total overflow duration of 221.4 hours. See Table 3-3 below for number of CSO events, and duration and volume of overflows.

Table 3-3 CSO Events, Durations and Volumes at Monitoring Sites

Month	CSO4A			CSO25			CSO29			CSO30		
	CSO Events	Overflow Duration (hours)	Overflow Volume (MG)	CSO Events	Overflow Duration (hours)	Overflow Volume (MG)	CSO Events	Overflow Duration (hours)	Overflow Volume (MG)	CSO Events	Overflow Duration (hours)	Overflow Volume (MG)
January	3	9.2	11.3	6	7.2	0.9	1	4.8	0.2	1	0.2	0.7
February	7	27.0	56.8	6	16.3	2.3	5	82.6	8.2	2	0.9	1.6
March	4	23.8	53.9	4	11.1	1.2	1	26.1	4.5	2	0.7	4.2
April	4	31.8	101.2	3	14.2	2.5	2	24.6	12.7	2	8.7	42.2
May	4	22.2	41.1	5	5.8	0.8	2	29.8	3.4	2	6.0	7.2
June	5	9.5	26.6	10	5.8	0.9	1	2.3	0.3	4	1.3	5.0
July	4	8.8	27.4	7	4.1	0.9	1	3.3	1.2	2	1.5	23.9
August	4	16.1	48.5	3	6.2	0.9	2	9.7	3.3	2	1.0	11.6
September	4	11.2	17.0	5	5.3	0.6	4	2.5	0.1	3	0.5	6.7
October	5	6.8	12.5	5	6.3	0.8	1	0.3	0.0	1	0.2	0.8
November	6	23.2	39.6	4	11.9	1.8	2	16.9	1.3	1	0.4	2.2
December	4	19.3	41.7	6	8.9	1.3	7	18.5	0.4	0	0.0	0.0
Total	**54**	**208.9**	**477.6**	**64**	**103.1**	**14.9**	**29**	**221.4**	**35.6**	**22**	**21.4**	**106.1**

The CSO crew members participate in CSO training which includes the following:

- Overview of CSOs and CSO controls
- Overview of the City's CSO program
- A discussion of the Nine Minimum Controls
- A session on CSO inspection and maintenance procedures
- The CSO crew is certified in confined space entry

Sewer crews participate in both formal and on-the-job training. Formal training includes sewer jet/vacuum truck operation and maintenance training provided by the equipment manufacturer, work zone safety training, and confined space training.

Funds have been allocated for the appropriate personnel and resources to accomplish the O&M Plan. Every year these costs are reviewed against any increased requirements for necessary adjustments.

3.4. **NMC #2** MAXIMIZE USE OF THE COLLECTION SYSTEM FOR STORAGE

PURPOSE

To reduce the frequency, magnitude and duration of wet weather CSOs by maximizing the existing collection system storage.

ACTIVITIES

The City has 3 storage facilities used for CSO abatement. They are Canby Park, Prices Run, and Clements & Shipley Run and have a storage capacity of 2.7 MG, 0.7 MG, and 1.6 MG respectively for a total storage capacity of 5 MG. The City continues to use the Real Time Control (RTC) system to actively manage flows in the system based on available interceptor capacity. In 2014 there were 843.4 MG of overflow from the City's collection system and the RTC system enabled the 3 storage facilities to store 204.6 MG. Considering the combined storage for all three facilities is 5 MG, they stored 40.9 times their total storage capacity thereby contributing to a 19.5% reduction of CSOs.

Table 3-4 below shows the stored volume summary for the 3 storage facilities. Note the number of storage events for Prices Run and Clements & Shipley Run exceeds the total number of rainfall events. This indicates that the RTC system was able to fill-up and dewater these storage facilities more than once per rainfall event in several cases. This observation shows the ability of the control strategy to maximize the storage and conveyance capacities available in the collection system in order to minimize CSO volumes for rainfall events exhibiting several peak intensities.

Table 3-4 Stored Volume Summary

Month	Number of Rainfall Events	Number Storage Events			Stored Volume (MG)			Solicitation Time (days)		
		Canby Park	Prices Run	Clements and Shipley Run	Canby Park	Prices Run	Clements and Shipley Run	Canby Park	Prices Run	Clements and Shipley Run
January	4	2	4	7	7.7	2.5	8.0	7.0	1.2	3.5
February	6	3	7	7	7.0	4.9	10.7	15.6	2.5	2.9
March	3	3	5	7	5.5	2.7	10.2	5.7	1.8	1.5
April	4	4	7	8	7.4	5.1	12.1	8.1	2.1	1.6
May	4	3	4	5	4.2	3.2	7.7	9.9	1.4	1.5
June	6	4	10	9	6.2	6.5	11.4	6.6	1.1	0.9
July	7	6	6	6	5.8	3.9	7.0	4.7	0.7	0.5
August	4	3	4	3	5.6	3.0	6.7	2.4	1.0	0.8
September	5	4	5	5	4.1	2.6	7.0	3.8	0.9	0.6
October	6	5	5	8	3.4	3.3	6.2	3.9	0.7	0.5
November	5	5	5	5	5.3	3.2	4.4	6.1	1.9	0.8
December	4	1	3	4	2.4	2.8	4.9	2.6	1.2	0.8
Total	**58**	**43**	**65**	**74**	**64.6**	**43.7**	**96.3**	**76.4**	**16.5**	**15.9**

RTC/CSO data is stored both at the plant and in an offsite location for future reference and retrieval.

All dams and diversion structures have been maintained at their current heights as of permit issuance.

3.5. **NMC #3** REVIEW AND MODIFY PRETREATMENT PROGRAM

PURPOSE

To identify non-domestic (commercial and industrial) dischargers to the combined sewer system that could have a significant impact on receiving stream quality.

ACTIVITIES

The City has been implementing an Industrial Pretreatment Program since 1984, which monitors commercial and industrial discharges to the combined sewer systems. In 1994 the City's consultant, conducted an assessment of water quality impacts on receiving waters. That study concludes that CSOs did not contribute to exceedances of the water quality standards for dissolved oxygen or toxics. Because oxygen demanding constituents and toxics are the significant constituents addressed in industrial user permits, the City concluded at that time that industrial discharges do not have a significant impact on CSOs.

The City only has 2 significant industrial users (SIUs) that discharge process wastewater into the CSS, both of which are batch dischargers. Cooperation through the pre-treatment program has been successful in controlling the batch discharges into the City's sewer system during rain events. All batch discharger permits contain requirements for the control of discharge during high flows, when applicable. The third SIU discharges directly into the plant and does not impact the CSO area. During the annual inspections of these facilities, the wet weather control strategies are discussed to determine their effectiveness and benefit. This is documented in the annual inspection reports.

3.6. **NMC #4** MAXIMIZE FLOW TO THE POTW TREATMENT PLANT

PURPOSE

To reduce the frequency, magnitude and duration of CSOs by maximizing the conveyance of flows thereby utilizing the capacities of the WWTP before a CSO occurs.

ACTIVITIES

The City continues to utilize the RTC program to improve wet weather flow management by increasing the conveyance of wet weather flows to the pumping station and the WWTP. The average treated flow rate during CSO periods was 141.6 MGD, of which, 67.2 MGD were from Wilmington (Table 3-5). The plant has a capacity of 250 MGD, therefore Wilmington could be pumping an additional 108.1 MGD during CSO periods without exceeding primary treatment plant capacity. During 2014, the 11th Street Pump Station has operated with 4 pumps running simultaneously only during the August 12th and 31st rainfall events. During these events, the maximal flow rate was 132.9 MGD.

Table 3-5 Regional WWTP and City of Wilmington Pumped Flow Summary

Month	Number of Days With Data	Regional WWTP Treated Flow Rates (MGD)		City of Wilmington 11th & 12th Street Pumped Flow Rates (MGD)	
		Max	Average During CSO period	Max	Average During CSO period
January	31.0	209.9	122.2	99.1	53.0
February	28.0	235.0	132.5	109.1	55.2
March	31.0	228.5	154.7	96.2	67.4
April	30.0	308.7	186.1	113.8	87.2
May	31.0	308.7	195.5	105.2	84.8
June	30.0	194.3	101.4	105.9	69.2
July	31.0	195.9	115.4	115.2	68.3
August	31.0	189.0	133.8	132.9	85.2
September	24.7	182.2	101.7	106.4	69.9
October	31.0	183.9	92.0	105.0	67.6
November	30.0	188.8	130.2	107.0	60.4
December	31.0	178.9	112.4	106.0	57.3
Max/Ave per year	**359.7**	**308.7**	**141.6**	**132.9**	**67.2**

RTC/CSO data is stored both at the plant and in an offsite location for future reference and retrieval.

3.7. **NMC #5** PROHIBIT COMBINED SEWER OVERFLOWS DURING DRY WEATHER

PURPOSE

To ensure that the CSOs in the system are only utilized during wet weather and that actions are taken to prevent and eliminate dry weather overflows.

ACTIVITIES

Routine inspections are performed daily in all CSO and tide gate/other structure locations to prevent and eliminate dry weather overflows. See Table 3-1 Summary of CSO Inspections Performed in 2014 and Table 3-2 Summary of Tide Gate and Other Structures Inspections Performed in 2014 above for additional inspection information.

In 2014, a total of two dry weather overflows were observed and reported. See Appendix B Dry Weather Overflows, for the notification letters and the nature of the dry weather overflow and corrective actions taken. Once a dry weather overflow is observed, the following actions are taken: Determine the source of the flow and take steps to rectify, continue to inspect until all flow has ceased, note cause and actions taken, and beginning and cessation of flow in the CSO inspection log.

3.8. **NMC #6** CONTROL OF SOLID AND FLOATABLE MATERIALS IN CSOS

PURPOSE

To control the discharge of visible floatables and solids by relatively simple means such as inlet cleaning, street sweeping, baffles and screens. The goal is to reduce the amount of visible pollutants getting into the CSS and subsequently discharged through the CSOs.

ACTIVITIES

The City's solid and floatable control program is based on an extensive street and catch basin cleaning program coupled with specific floatable control at high priority locations.

The City has recently instituted a new City-wide inspection plan to ensure all inlets are inspected, at a minimum, once per permit cycle. Data from this new program will be reported in the 2015 CSO Annual Report. Before the new inspection program was initiated the City continued to inspect and maintain inlets, inlets within critical areas and prone to flooding are inspected more frequently. In 2014, 255 tons of debris was removed from the inlets and subsequently kept out the CSS.

The City also performs routine street sweeping activities throughout the city and in 2014 kept 750 tons of debris from entering the CSS.

The City continues to implement measures to control solid and floatable materials at CSO27 trash rack at Lancaster and Webb, and CSO30 at Madison Street Conectiv Yard.

3.9. **NMC #7** DEVELOP AND IMPLEMENT POLLUTION PREVENTION PROGRAMS

PURPOSE

To keep pollutants that may be harmful to the receiving waters out of the CSS so they cannot be discharged to the receiving waters. This is accomplished by placing controls on industrial discharges (see section 3.5 **NMC #3** Review and Modify Pretreatment Program), inlet and street cleaning programs (see section 3.8 **NMC #6** Control of Solid and Floatable Materials in CSOs), by educating the public on proper disposal of waste and automotive fluids, and through litter control programs.

ACTIVITIES

The City continues to work closely with The Partnership of the Delaware Estuary and DNREC identifying potential education opportunities, including the City's annual Earth Day celebration in April 2014.

In 2014 the City continued co-sponsored the City of Wilmington's Green Jobs Program which engaged the City's youth by providing green-collar work opportunities. Summer interns participated in a 6-week hands-on work experience and classroom environmental education that introduced them to environmental issues and careers. By participating in this program Wilmington's youth can help to transform the City into a greener, cleaner, safer community while experiencing meaningful employment and education opportunities. Topics covered in this

program included watersheds, non-point source pollution, and storm drain marking. This program was made possible by the cooperation of many agencies including the Water Resources Agency, the Partnership for the Delaware Estuary, Delaware Center for Horticulture, Delaware Nature Society Urban Environmental Center, and Challenge Program.

The City conducted an initial analysis of the current City codes and ordinances in 2012 to determine if there are barriers to the implementation of green stormwater infrastructure and opportunities to adjust ordinances and codes to incentivize stormwater management with existing mechanisms. The City is continuing internal review and discussions related to the study findings.

3.10. **NMC #8** NOTIFY THE PUBLIC OF CSOS

PURPOSE

To ensure the public receives adequate notification of CSO events and impacts, if any, on affected public water use areas.

ACTIVITIES

The City continues to inspect and maintain approximately 73 signs installed at 42 CSO locations and/or water access points, notifying the public of CSO wet weather discharges. The results of these inspections are recorded on the daily inspection log.

The City continued, in 2014, to run routine radio spots to inform the public of CSOs, and the conditions under which they occur. This practice began on February 17, 2002. During 2014, this message played on the WILM (1450am) local radio station 2 times a week and streaming 2 times a week, both during drive times (i.e. morning and afternoon commutes).

3.11. **NMC #9** MONITOR TO EFFECTIVELY CHARACTERIZE CSO IMPACTS AND THE EFFICACY OF CSO CONTROLS

PURPOSE

To obtain an initial characterization of the combined sewer system, and to collect and document information on overflows occurrences and known water quality problems and incidents that reflects the impact of the CSO on the receiving stream.

Water quality measures track conditions in water bodies that are potentially impacted by CSO discharges and can be used to quantify impacts, to assess compliance with Delaware Surface Water Quality Standards, and to compare upstream conditions with conditions in waters potentially impacted by CSO discharges. Water quality measures are primarily focused upon indicators for which there are water quality criteria.

ACTIVITIES

In addition to visual inspections occurring daily during outfall inspections, sampling has been completed monthly since March of 2006. The monitoring program entails sampling at 7 locations in the Christina Basin as shown in Table 3-6 below. The samples at each location are analyzed for the parameters indicated in Table 3-7 below. See Table 3-8 for monitoring data for calendar year 2014.

Table 3-6 Sampling Locations

City of Wilmington Sample Location ID	Station Location Description	Comment
COW_BC-S1	Brandywine Creek at Smith Bridge	Upstream of CSOs
COW_BC-S2	Brandywine Creek, RD 279 Bridge, Dupont Experimental Station	Upstream of CSOs, just upstream of Rockford Road CSO
COW_BC-S3	Brandywine Creek, Foot Bridge	Downstream of Rockford Road CSO
COW_BC-S4	Brandywine Creek, Northeast Blvd Bridge	Tidal Brandywine, In vicinity of CSOs 25, 26, 24, 23, 4(a–f), 22 (b-c), 23, 21 (a–c). Adjacent to CSOs 20, 19, & 3
COW_CR-S5	Christina River, US 13 at 3rd Street Bridge	Tidal Christina; In vicinity of CSOs 30, 5, 6, 7, 11, 12, 13, 10, 14, 15,17, 16, 9A, and 9B
COW_CR-S6	Christina River, Railroad Bridge	
COW-CR-S7	Little Mill Creek at Maryland Avenue Bridge	Downstream of CSOs 27, 28, & 29

Table 3-7 Parameters Monitored

Parameter Group	Parameter	Units	Analytical Method	Comment
Physical	Temperature	^{o}C		Measured in field
	Daily Rainfall	inches		http://www.deos.udel.edu/ monthly_retrieval.php
	pH	Units	SM4500	Measured in field
	Alkalinity	mg/L as $CaCO_3$	SM2320B	Measured in lab; 14 day hold time at 4^{o}C
	Hardness	mg/L as $CaCO_3$	SM2340C	Measured in lab
	Conductivity	µmhos/cm	SM2510B	Measured in lab; 28 day hold time at 4^{o}C
Microbiological	Enterococci	#/100 mL	IDEXX Enterolert Quanti-tray	Measured in lab;
	Total Coliform/*E. Coli*	#/100 mL	IDEXX Colilert Quanti-tray	Measured in lab 30 h hold time at 4^{o}C
Organic	Total Organic Carbon	mg/L	SM5310C	Measured in lab 28 day hold time at 4^{o}C; preserved with 1 mL H_3PO_4
	UV Absorbance @ 254nm	cm-1	SM5910C	Measured in lab immediately
Particulate	Turbidity	NTU	SM2310B	Measured in lab
	Total Suspended Solids	mg/L		Measured in lab; 24 hour hold time at 4^{o}C
Metals	Iron	mg/L	SM3500B	Measured in lab immediately

Parameter Group	Parameter	Units	Analytical Method	Comment
	Manganese	mg/L	Hach Pan Method	Measured in lab immediately
Nutrients	Phosphate	mg/L as P	SM4500E	Measured in lab; 48 hour hold time at 4^{o}C
	Nitrate	mg/L as N	SM4500E	Measured in lab; 48 hour hold time at 4^{o}C

Lastly, efficiency of CSO control mechanisms are also measured by the amount of debris that was prevented from entering the receiving waters as well as the number of dry weather overflows that were prevented. We also evaluate flow data from 11th street pumping station to determine whether the procedures in place for maximizing flow to the POTW are effective. This annual report is the mechanism for this review as well as the information presented.

Table 3-8 2014 Water Quality Data

Sample Dates 1/15/14 through 4/16/14

Sample Location ID	Station ID	Date	Rainfall Intensity (inches)	Total Coliform (MPN) (#/100mL)	E.Coli (MPN) (#/100mL)	Enterococci (MPN) (#/100mL)	Turb (NTU)	TSS (mg/L)	Temp ° C	pH (units)
WS1	Brandywine Creek at Smith Bridge	1/15/2014	0.01	2419.6	166.4	178.2	14.7	8	16.1	8.2
WS2	Brandywine Creek at Exp. Station	1/15/2014	0.01	2419.6	365.4	154.1	11.5	10	16.1	8.3
WS3	Brandywine Creek at Footbridge	1/15/2014	0.01	2419.6	285.1	75.4	7.49	6	16.5	8.2
WS4	Brandywine Creek at Northeast	1/15/2014	0.01	2419.6	1299.7	201.4	8.37	6	16.9	8.1
WS5	Christina River at 3rd St. Bridge	1/15/2014	0.01	2419.6	517.2	1732.9	18.5	14	15.1	7.8
WS6	Christina River - 7th St. Peninsula	1/15/2014	0.01	2419.6	410.6	737	9.56	ND	15.8	8
WS7	Little Mill Creek at MD Ave Bridge	1/15/2014	0.01	2419.6	648.8	313	6.86	9	16.2	7.7
WS1	Brandywine Creek at Smith Bridge	2/19/2014	0.34	478.8	59.1	2	5.55	ND	19.1	8.6
WS2	Brandywine Creek at Exp. Station	2/19/2014	0.34	396.8	77.6	10.9	3.84	ND	20.8	7.8
WS3	Brandywine Creek at Footbridge	2/19/2014	0.34	686.7	53.8	16	3.67	ND	20.1	8
WS4	Brandywine Creek at Northeast	2/19/2014	0.34	1986.3	461.1	48	5.22	ND	21.5	7.5
WS5	Christina River at 3rd St. Bridge	2/19/2014	0.34	412	139.1	90.6	5.06	13	19.6	7.6
WS6	Christina River - 7th St. Peninsula	2/19/2014	0.34	2419.6	151.5	135.4	32.3	31	20.5	7.5
WS7	Little Mill Creek at MD Ave Bridge	2/19/2014	0.34	2419.6	2419.6	2419.6	73.4	97	21	7.4
WS1	Brandywine Creek at Smith Bridge	3/19/2014	0.62	579.4	31.3	4.1	3.24	ND	8.1	7.3
WS2	Brandywine Creek at Exp. Station	3/19/2014	0.62	866.4	8.6	488.4	1.99	ND	8.2	7.6
WS3	Brandywine Creek at Footbridge	3/19/2014	0.62	435.2	26.2	9	3.08	ND	8	7.8
WS4	Brandywine Creek at Northeast	3/19/2014	0.62	727	25.6	9.7	3.54	ND	7.1	7.8
WS5	Christina River at 3rd St. Bridge	3/19/2014	0.62	1732.9	61.3	28.5	16.2	13	7.9	7.4
WS6	Christina River - 7th St. Peninsula	3/19/2014	0.62	1732.9	70.3	42.8	18.9	3	7.5	7.5
WS7	Little Mill Creek at MD Ave Bridge	3/19/2014	0.62	770.1	111.9	28.8	6.54	4	7.5	8
WS1	Brandywine Creek at Smith Bridge	4/16/2014	0	2419.6	2419.6	2419.6	88.8	95	9.8	7.3
WS2	Brandywine Creek at Exp. Station	4/16/2014	0	2419.6	2419.6	2419.6	115	106	9.4	7.6
WS3	Brandywine Creek at Footbridge	4/16/2014	0	2419.6	2419.6	2419.6	136	109	6.2	8
WS4	Brandywine Creek at Northeast	4/16/2014	0	2419.6	2419.6	2419.6	141	112	11.1	7.6
WS5	Christina River at 3rd St. Bridge	4/16/2014	0	2419.6	1299.7	2419.6	88.2	67	12.3	7.3
WS6	Christina River - 7th St. Peninsula	4/16/2014	0	2419.6	2419.6	2419.6	109	84	6.7	7.7
WS7	Little Mill Creek at MD Ave Bridge	4/16/2014	0	2419.6	1299.7	2419.6	14.2	11	10.1	7.6

Sample Dates 1/15/14 through 4/16/14

Sample Location ID	Station ID	Date	Alk (mg/L as CaCO3)	Hardness (mg/L as CaCO3)	Cond (mhos/cm)	Total Fe (mg/L)	Total Mn (mg/L)	NO3 (mg/L as N)	PO4 (mg/L as P)	TOC (mg/L)	UV Abs (cm-1)
WS1	Brandywine Creek at Smith Bridge	1/15/2014	50	90	308	0.38	0.07	0.9	0.16	2.37	0.085
WS2	Brandywine Creek at Exp. Station	1/15/2014	50	90	333	0.18	0.043	0.8	0.2	2.23	0.081
WS3	Brandywine Creek at Footbridge	1/15/2014	53	96	331	0.32	0.051	1.1	0.33	2.55	0.081
WS4	Brandywine Creek at Northeast	1/15/2014	53	88	324	0.22	0.042	1	0.21	2.59	0.079
WS5	Christina River at 3rd St. Bridge	1/15/2014	46	78	395	0.42	0.12	1.3	0.26	3.76	0.156
WS6	Christina River - 7th St. Peninsula	1/15/2014	50	90	339	0.23	0.07	1.3	0.24	2.84	0.096
WS7	Little Mill Creek at MD Ave Bridge	1/15/2014	58	116	756	0.39	0.093	0.7	0.14	2.71	0.181
WS1	Brandywine Creek at Smith Bridge	2/19/2014	56	104	311	0.21		0.8	0.19	1.36	0.045
WS2	Brandywine Creek at Exp. Station	2/19/2014	52	102	458	0.18		0.9	0.18	1.35	0.046
WS3	Brandywine Creek at Footbridge	2/19/2014	51	100	463	0.16		1	0.18	1.29	0.043
WS4	Brandywine Creek at Northeast	2/19/2014	50	98	465	0.22		1.2	0.25	1.38	0.043
WS5	Christina River at 3rd St. Bridge	2/19/2014	48	106	853	0.51		1.1	0.17	1.57	0.094
WS6	Christina River - 7th St. Peninsula	2/19/2014	49	104	802	0.76		1.5	0.33	1.75	0.084
WS7	Little Mill Creek at MD Ave Bridge	2/19/2014	28	84	1768	1.62		1.1	0.21	2.22	0.113
WS1	Brandywine Creek at Smith Bridge	3/19/2014	50	108	321	0.11	0.048	1			0.053
WS2	Brandywine Creek at Exp. Station	3/19/2014	61	232	1871	0.1	0.262	0.2			0.055
WS3	Brandywine Creek at Footbridge	3/19/2014	49	94	393	0.12	0.042	1.1			0.053
WS4	Brandywine Creek at Northeast	3/19/2014	45	96	395	0.17	0.045	0.9			0.054
WS5	Christina River at 3rd St. Bridge	3/19/2014	51	100	493	0.44	0.111	1			0.093
WS6	Christina River - 7th St. Peninsula	3/19/2014	51	98	514	0.39	0.124	1.2			0.095
WS7	Little Mill Creek at MD Ave Bridge	3/19/2014	56	148	1716	0.43	144	0.3			0.081
WS1	Brandywine Creek at Smith Bridge	4/16/2014	38	56	190	2.08	0.24	2.1	0.29	7.44	0.310
WS2	Brandywine Creek at Exp. Station	4/16/2014	32	54	178	1.42	0.32	2.1	0.25	7.42	0.313
WS3	Brandywine Creek at Footbridge	4/16/2014	29	54	180	2.49	0.474	2.4	0.23	7.49	0.327
WS4	Brandywine Creek at Northeast	4/16/2014	34	54	181	1.7	0.27	2.3	0.27	7.24	0.338
WS5	Christina River at 3rd St. Bridge	4/16/2014	38	62	318	1.42	0.297	2.6	0.31	7.29	0.371
WS6	Christina River - 7th St. Peninsula	4/16/2014	33	58	193	2.12	0.239	2.4	0.27	7.16	0.327
WS7	Little Mill Creek at MD Ave Bridge	4/16/2014	44	78	464	0.62	0.105	0.9	0.17	5.58	0.320

Sample Dates 5/14/14 through 8/20/14

Sample Location ID	Station ID	Date	Rainfall Intensity (inches)	Total Coliform (MPN) (#/100mL)	E.Coli (MPN) (#/100mL)	Enterococci (MPN) (#/100mL)	Turb (NTU)	TSS (mg/L)	Temp °C	pH (units)
WS1	Brandywine Creek at Smith Bridge	5/14/2014	0	1553.1	517.2	816.4	6.52	7	16.8	7.6
WS2	Brandywine Creek at Exp. Station	5/14/2014	0	1732.9	547.5	235.9	4.39	3	17	8
WS3	Brandywine Creek at Footbridge	5/14/2014	0	2419.6	461.1	178.5	4.81	5	17.8	8.2
WS4	Brandywine Creek at Northeast	5/14/2014	0	1299.7	686.7	235.9	4.54	ND	17.7	8.1
WS5	Christina River at 3rd St. Bridge	5/14/2014	0	2419.6	344.8	270	9.16	15	18.8	7.6
WS6	Christina River - 7th St. Peninsula	5/14/2014	0	2419.6	261.3	149.7	7.21	11	19	7.6
WS7	Little Mill Creek at MD Ave Bridge	5/14/2014	0	2419.6	461.1	235.9	2.31	2	17.9	7.4
WS1	Brandywine Creek at Smith Bridge	6/18/2014	0	2419.6	185	259.5	3.75	3		7.9
WS2	Brandywine Creek at Exp. Station	6/18/2014	0	2419.6	133.4	178	3.06	ND		7.8
WS3	Brandywine Creek at Footbridge	6/18/2014	0	2419.6	142.1	100.8	3.16	ND		8.1
WS4	Brandywine Creek at Northeast	6/18/2014	0	2419.6	410.6	77.6	3.99	ND		8.1
WS5	Christina River at 3rd St. Bridge	6/18/2014	0	2419.6	1732.9	980.4	169	322		7.5
WS6	Christina River - 7th St. Peninsula	6/18/2014	0	2419.6	88.8	387.3	12.3	23		7.7
WS7	Little Mill Creek at MD Ave Bridge	6/18/2014	0	2419.6	816.4	248.1	2.14	ND		7.9
WS1	Brandywine Creek at Smith Bridge	7/16/2014		2419.6	2419.6	2419.6	50	45	22	7.8
WS2	Brandywine Creek at Exp. Station	7/16/2014		2419.6	2419.6	2419.6	92.6	72	23	7.9
WS3	Brandywine Creek at Footbridge	7/16/2014								
WS4	Brandywine Creek at Northeast	7/16/2014		2419.6	2419.6	2419.6	64	115	23	7.9
WS5	Christina River at 3rd St. Bridge	7/16/2014		2419.6	1413.6	461.1	16.9	13	27	7.4
WS6	Christina River - 7th St. Peninsula	7/16/2014		2419.6	1553.1	920.8	9.92	6	26	7.7
WS7	Little Mill Creek at MD Ave Bridge	7/16/2014		2419.6	1553.1	435.2	3.45	ND	25	7.9
WS1	Brandywine Creek at Smith Bridge	8/20/2014	0	2419.6	49.6	191.8	1.75	ND	21.9	8.2
WS2	Brandywine Creek at Exp. Station	8/20/2014	0	2419.6	116.9	93.3	2.36	ND	23.2	8.3
WS3	Brandywine Creek at Footbridge	8/20/2014	0							
WS4	Brandywine Creek at Northeast	8/20/2014	0	2419.6	240	123.4	2.75	5	25.7	8.4
WS5	Christina River at 3rd St. Bridge	8/20/2014	0	2419.6	111.2	98.5	24.4	5	25.7	7.9
WS6	Christina River - 7th St. Peninsula	8/20/2014	0	2419.6	78.9	119.8	16.7	ND	25.4	8
WS7	Little Mill Creek at MD Ave Bridge	8/20/2014	0	2419.6	189.2	275.5	1.81	ND	24.9	8.8

Sample Dates 5/14/14 through 8/20/14

Sample Location ID	Station ID	Date	Alk (mg/L as CaCO3)	Hardness (mg/L as CaCO3)	Cond (mhos/cm)	Total Fe (mg/L)	Total Mn (mg/L)	NO3 (mg/L as N)	PO4 (mg/L as P)	TOC (mg/L)	UV Abs (cm-1)
WS1	Brandywine Creek at Smith Bridge	5/14/2014	45	84	279	0.12	0.031	1.1	0.21		0.082
WS2	Brandywine Creek at Exp. Station	5/14/2014	49	92	297	0.12	0.026	1	0.27		0.073
WS3	Brandywine Creek at Footbridge	5/14/2014	47	88	297	0.11	0.027	1.3	0.12		0.068
WS4	Brandywine Creek at Northeast	5/14/2014	49	90	295	0.1	0.024	0.9	0.17		0.072
WS5	Christina River at 3rd St. Bridge	5/14/2014	46	92	296	0.4	0.091	1.1	0.2		0.096
WS6	Christina River - 7th St. Peninsula	5/14/2014	47	92	305	0.24	0.076	0.9	0.18		0.099
WS7	Little Mill Creek at MD Ave Bridge	5/14/2014	58	186	699	0.27	0.059	0.5	0.19		0.097
WS1	Brandywine Creek at Smith Bridge	6/18/2014	53	94	293	0.12	0.035	0.7	0.22	2.26	0.080
WS2	Brandywine Creek at Exp. Station	6/18/2014	50	102	300	0.11	0.024	0.7	0.32	2.22	0.079
WS3	Brandywine Creek at Footbridge	6/18/2014	52	100	306	0.1	0.02	0.7	0.52	2.24	0.078
WS4	Brandywine Creek at Northeast	6/18/2014	49	100	305	0.12	0.025	0.7	0.22	4.68	0.077
WS5	Christina River at 3rd St. Bridge	6/18/2014	57	96	323	3.89	0.687	2.5	0.07	2.28	0.170
WS6	Christina River - 7th St. Peninsula	6/18/2014	46	102	303	0.34	0.074	0.7	0.07	4.20	0.167
WS7	Little Mill Creek at MD Ave Bridge	6/18/2014	82	158	563	0.31	0.055	0.3	0.15	1.43	0.106
WS1	Brandywine Creek at Smith Bridge	7/16/2014	37	60	156	1.23	0.222	1.7	0.26	5.46	0.233
WS2	Brandywine Creek at Exp. Station	7/16/2014	43	72	222	1.62	0.199	1.6	0.19	4.77	0.188
WS3	Brandywine Creek at Footbridge	7/16/2014									
WS4	Brandywine Creek at Northeast	7/16/2014	56	96	302	1.14	0.079	1.2	0.33	2.87	0.101
WS5	Christina River at 3rd St. Bridge	7/16/2014	56	98	387	0.42	0.128	0.7	0.27	3.27	0.125
WS6	Christina River - 7th St. Peninsula	7/16/2014	48	86	369	0.22	0.097	0.8	0.19	3.10	0.119
WS7	Little Mill Creek at MD Ave Bridge	7/16/2014	44	82	314	0.22	0.032	0.3	0.32	4.16	0.176
WS1	Brandywine Creek at Smith Bridge	8/20/2014	62	116	353	0.09	0.023	0.6	0.33	3.41	0.072
WS2	Brandywine Creek at Exp. Station	8/20/2014	65	112	357	0.1	0.032	0.6	0.28	2.08	0.071
WS3	Brandywine Creek at Footbridge	8/20/2014									
WS4	Brandywine Creek at Northeast	8/20/2014	68	118	380	0.13	0.077	0.7	0.25	2.16	0.070
WS5	Christina River at 3rd St. Bridge	8/20/2014	50	264	2200	0.39	0.153	0.6	0.11		0.111
WS6	Christina River - 7th St. Peninsula	8/20/2014	51	218	1744	0.25	0.105	0.7	0.26		0.106
WS7	Little Mill Creek at MD Ave Bridge	8/20/2014	66	178	573	0.26	0.033	0.1	0.19		0.087

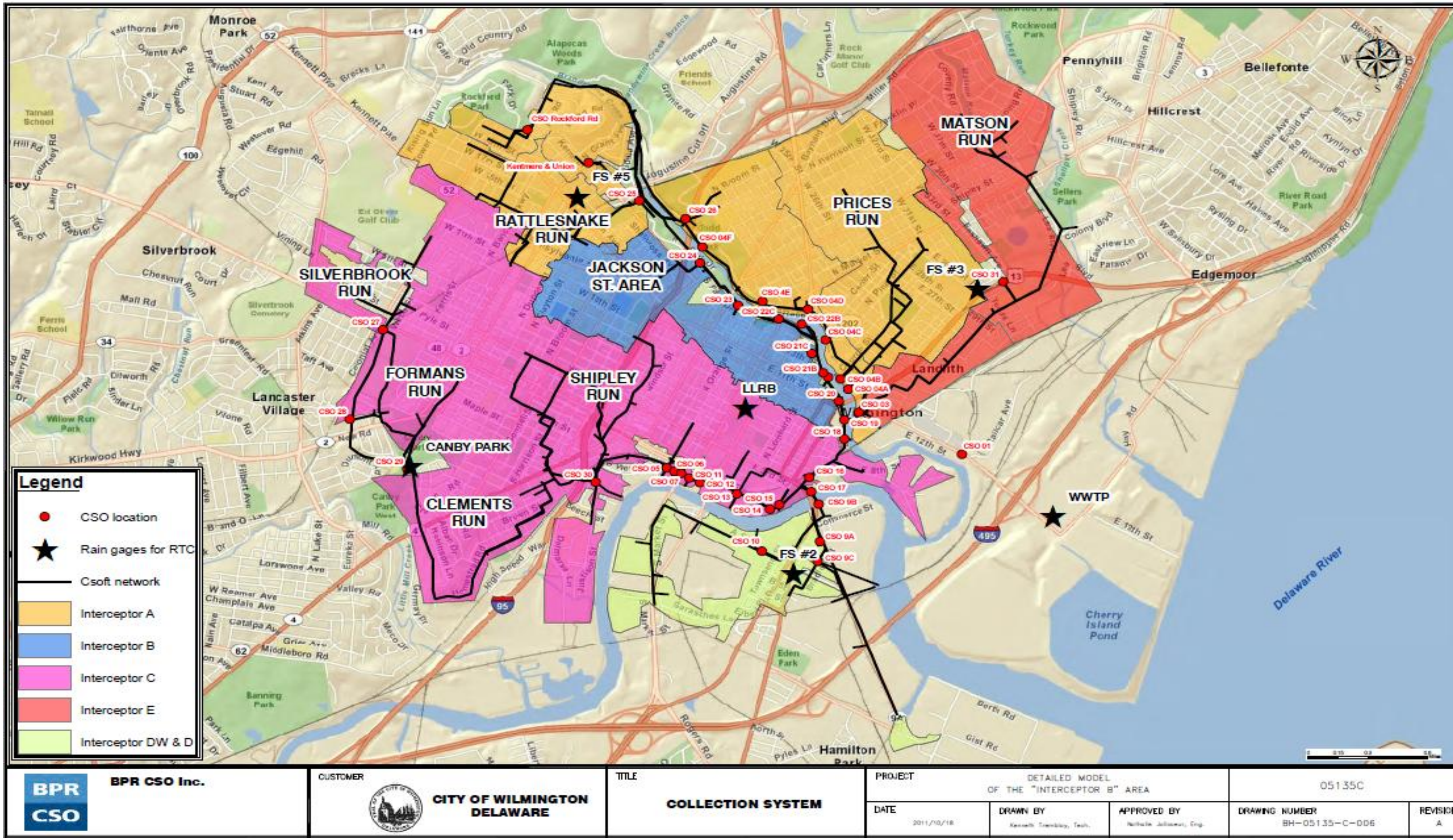
Sample Dates 9/18/14 through 12/17/14

Sample Location ID	Station ID	Date	Rainfall Intensity (inches)	Total Coliform (MPN) (#/100mL)	E.Coli (MPN) (#/100mL)	Enterococci (MPN) (#/100mL)	Turb (NTU)	TSS (mg/L)	Temp °C	pH (units)
WS1	Brandywine Creek at Smith Bridge	9/18/2014	0	2419.6	88.6	980.4	2.42	0	16.5	7.8
WS2	Brandywine Creek at Exp. Station	9/18/2014	0	2419.6	73.3	144.5	3.14	0	18.6	8
WS3	Brandywine Creek at Footbridge	9/18/2014	0	1986.3	42	168.2	3.21	0	19.1	8.1
WS4	Brandywine Creek at Northeast	9/18/2014	0	2419.6	193.5	67.6	2.48	0	19.1	8
WS5	Christina River at 3rd St. Bridge	9/18/2014	0	2419.6	613.1	178.9	17.5	5	23.4	7.5
WS6	Christina River - 7th St. Peninsula	9/18/2014	0	2419.6	110	307.6	11.9	11	23.2	7.5
WS7	Little Mill Creek at MD Ave Bridge	9/18/2014	0	2419.6	113	43.5	1.28	0	20.3	8.1
WS1	Brandywine Creek at Smith Bridge	10/15/2014	0.23	1299.7	111.2	139.1	1.85	ND	18.4	7.7
WS2	Brandywine Creek at Exp. Station	10/15/2014	0.23	2419.6	111.9	93.4	1.73	ND	18.8	8
WS3	Brandywine Creek at Footbridge	10/15/2014	0.23	2419.6	157.6	126.7	1.59	ND	18.3	8
WS4	Brandywine Creek at Northeast	10/15/2014	0.23	2419.6	151.5	79.4	1.11	ND	18.5	7.9
WS5	Christina River at 3rd St. Bridge	10/15/2014	0.23	2419.6	126.7	209.8	7.46	ND	19.5	7.5
WS6	Christina River - 7th St. Peninsula	10/15/2014	0.23	1732.9	71.2	135.4	10.1	ND	19.9	7.7
WS7	Little Mill Creek at MD Ave Bridge	10/15/2014	0.23	2419.6	135.4	178.9	1.42	ND	19.6	7.8
WS1	Brandywine Creek at Smith Bridge	11/19/2014	0	2419.6	1986.3	2419.6	9.16	ND	2.7	8.7
WS2	Brandywine Creek at Exp. Station	11/19/2014	0	2419.6	1986.3	2419.6	6.17	2	1.8	8.2
WS3	Brandywine Creek at Footbridge	11/19/2014	0	2419.6	1986.3	2419.6	6.44	2	2.2	8
WS4	Brandywine Creek at Northeast	11/19/2014	0	2419.6	1732.9	2419.6	9.23	ND	3.4	8.1
WS5	Christina River at 3rd St. Bridge	11/19/2014	0	2419.6	1299.7	2419.6	12.8	ND	6.8	7.8
WS6	Christina River - 7th St. Peninsula	11/19/2014	0	2419.6	488.4	1413.6	16.9	11	7.3	7.3
WS7	Little Mill Creek at MD Ave Bridge	11/19/2014	0	2419.6	1119.9	579.4	7.52	ND	3.6	8.1
WS1	Brandywine Creek at Smith Bridge	12/17/2014	0	920.8	73.3	13.5	2.25	ND	6.1	7.4
WS2	Brandywine Creek at Exp. Station	12/17/2014	0	980.4	33.6	7.5	1.42	ND	6.1	7.6
WS3	Brandywine Creek at Footbridge	12/17/2014	0	727	27.5	13.4	1.65	ND	6.2	7.6
WS4	Brandywine Creek at Northeast	12/17/2014	0	920.8	43.5	22.6	1.54	ND	6.8	7.5
WS5	Christina River at 3rd St. Bridge	12/17/2014	0	980.4	55.4	224.7	52.8	47	6.5	7.1
WS6	Christina River - 7th St. Peninsula	12/17/2014	0	980.4	58.1	83.6	43.2	31	6.7	7.2
WS7	Little Mill Creek at MD Ave Bridge	12/17/2014	0	1203.3	155.3	77.2	44.8	ND	7.3	8.1

Sample Dates 9/18/14 through 12/17/14

Sample Location ID	Station ID	Date	Alk (mg/L as CaCO3)	Hardness (mg/L as CaCO3)	Cond (mhos/cm)	Total Fe (mg/L)	Total Mn (mg/L)	NO3 (mg/L as N)	PO4 (mg/L as P)	TOC (mg/L)	UV Abs (cm-1)
WS1	Brandywine Creek at Smith Bridge	9/18/2014	68	118	354	0.12	0.035	0.9	0.38	2.07	0.059
WS2	Brandywine Creek at Exp. Station	9/18/2014	66	118	359	0.11	0.038	1.1	0.32	1.86	0.059
WS3	Brandywine Creek at Footbridge	9/18/2014	64	114	358	0.1	0.026	0.9	0.51	1.92	0.061
WS4	Brandywine Creek at Northeast	9/18/2014	69	118	366	0.1	0.036	0.8	0.41	1.88	0.060
WS5	Christina River at 3rd St. Bridge	9/18/2014	59	376	3450	0.22	0.088	0.6	0.4	0.85	0.089
WS6	Christina River - 7th St. Peninsula	9/18/2014	57	340	3160	0.2	0.078	0.8	0.3	0.80	0.084
WS7	Little Mill Creek at MD Ave Bridge	9/18/2014	62	140	542	0.24	0.027	0.2	0.14	1.89	0.092
WS1	Brandywine Creek at Smith Bridge	10/15/2014	68	118	361	0.07	0.01	0.6	0.24	2.89	0.072
WS2	Brandywine Creek at Exp. Station	10/15/2014	65	120	353	0.08	0.014	0.6	0.22	2.39	0.075
WS3	Brandywine Creek at Footbridge	10/15/2014	62	116	352	0.09	0.014	0.4	0.2	2.32	0.068
WS4	Brandywine Creek at Northeast	10/15/2014	63	114	343	0.08	0.012	0.5	0.17	2.30	0.072
WS5	Christina River at 3rd St. Bridge	10/15/2014	60	442	4200	0.14	0.062	0.5	0.2	0.83	0.093
WS6	Christina River - 7th St. Peninsula	10/15/2014	63	518	4800	0.1	0.047	0.6	0.27	N/A	0.084
WS7	Little Mill Creek at MD Ave Bridge	10/15/2014	66	162	499	0.25	0.022	0.3	0.05	N/A	0.097
WS1	Brandywine Creek at Smith Bridge	11/19/2014	55	96	283	0.2	0.045	1.1	0.18	4.71	0.151
WS2	Brandywine Creek at Exp. Station	11/19/2014	51	88	267	0.18	0.04	1.2	0.14	4.06	0.148
WS3	Brandywine Creek at Footbridge	11/19/2014	51	86	261	0.19	0.042	0.9	0.16	3.85	0.138
WS4	Brandywine Creek at Northeast	11/19/2014	52	92	274	0.18	0.041	0.9	0.16	0.374	0.135
WS5	Christina River at 3rd St. Bridge	11/19/2014	61	350	2970	0.34	0.109	1.2	0.21	0.91	0.118
WS6	Christina River - 7th St. Peninsula	11/19/2014	60	320	2450	0.33	0.123	1.3	0.24	0.9	0.112
WS7	Little Mill Creek at MD Ave Bridge	11/19/2014	53	114	388	0.37	0.066	0.06	0.09	3.73	0.164
WS1	Brandywine Creek at Smith Bridge	12/17/2014	61	114	353	0.14	0.039	0.9	0.18	2.21	0.064
WS2	Brandywine Creek at Exp. Station	12/17/2014	61	112	361	0.13	0.031	0.8	0.15	2.14	0.065
WS3	Brandywine Creek at Footbridge	12/17/2014	63	112	366	0.13	0.031	0.5	0.16	2.08	0.062
WS4	Brandywine Creek at Northeast	12/17/2014	60	114	367	0.13	0.028	0.8	0.14	2.07	0.062
WS5	Christina River at 3rd St. Bridge	12/17/2014	61	216	1357	0.57	0.276	1.7	0.3	1.45	0.065
WS6	Christina River - 7th St. Peninsula	12/17/2014	59	176	1047	0.65	0.212	1.8	0.29	1.76	0.112
WS7	Little Mill Creek at MD Ave Bridge	12/17/2014	63	176	1035	0.37	0.073	0.6	0.05	2.21	0.092

APPENDIX A CITY OF WILMINGTON CSO SITES


MATSON RUN
PRICES RUN
RATTLESNAKE RUN
FS #5
JACKSON ST. AREA
SILVERBROOK RUN
FORMANS RUN
SHIPLEY RUN
LLRB
FS #3
CANBY PARK
CLEMENTS RUN
FS #2
WWTP
Delaware River
Cherry Island Pond
Legend
CSO location
Rain gages for RTC
Csoft network
Interceptor A
Interceptor B
Interceptor C
Interceptor E
Interceptor DW & D
BPR CSO
BPR CSO Inc.
CUSTOMER
CITY OF WILMINGTON DELAWARE
TITLE
COLLECTION SYSTEM
PROJECT
DETAILED MODEL OF THE "INTERCEPTOR B" AREA
05135C
DATE
2011/10/18
DRAWN BY
APPROVED BY
DRAWING NUMBER
BH-05135-C-006
REVISION
A

APPENDIX B DRY WEATHER OVERFLOWS

City of Wilmington
Delaware

DENNIS P. WILLIAMS
MAYOR

LOUIS R. REDDING - CITY/COUNTY BUILDING
800 FRENCH STREET
WILMINGTON, DELAWARE
19801-3537
WWW.WILMINGTONDE.GOV

February 10, 2014

Mr. Anthony E. Hummel, P.E.
DNREC -Division of Water Resources
Surface Water Discharges Section
89 Kings Highway
Dover, Delaware 19901

RE: Discovery of a Dry Weather Overflow at CSO 4B
NPDES Permit #DE0020320

Dear Mr. Hummel:

This letter serves as a formal notification regarding the City's recent discovery of a combined sewer overflow at CSO 4B on Thursday, February 6, 2014. CSO 4B is located at the foot of Church Street (see attached map). The overflow was discovered by our CSO Supervisor, Matt Copeland at 7:41 a.m. on Thursday during the CSO Crews daily inspection. Mr. Copeland reported that the sewer flow was overflowing the regulator, but no flow was observed at the outfall located on Brandywine Creek. The CSO Crew conducted a site visit of the Porter filter plant at 7:50 am, signed in, and talked to operators about possible filter backwashing. The operator stated they were finishing one filter and preparing to wash another. The crew returned to CSO4B at 8:20 am and flow was just barely below the crest of the regulator. The crew again returned to CSO4B at 12:10 pm and observed that the small flow was over the regulator (not as much as at 7:41) and still no overflow at the outfall. Although no flow was observed discharging to the Brandywine the City can only assume that some of this flow may have made its way to the outfall due to the design of the combined system. As follow up actions the City will schedule the CSO Crew to be present at the regulator and outfall for the entire cycle of a backwash at Porter filter plant.

The City remains committed to preventing dry weather overflows through the daily inspection of CSO regulators and outfalls by the CSO crew. The regulator and outfall for CSO 4B are inspected daily Monday thru Friday and the last inspection prior to the dry weather overflow was conducted on Wednesday, February 5th.

If you have any additional questions regarding this incident, please call me at (302) 576-2556. Also, if you would like to tour the site I would be happy to schedule a site visit to this location.

Sincerely,

Mary Neutz

Mary Neutz
Environmental Programs Manager

cc: Clean L. Cauley, Public Works Commissioner (via e-mail)
Sean Duffy, Water Division Director, Public Works (via e-mail)
Bryan Lennon, Assistant Water Division Director, Public Works (via e-mail)
Kara Coats, First Assistant City Solicitor, City Solicitor's Office (via e-mail)
Aleksey Reznik, Project Manager, Veolia (via e-mail)

City of Wilmington
Delaware

DENNIS P. WILLIAMS
MAYOR

LOUIS R. REDDING · CITY/COUNTY BUILDING
800 FRENCH STREET
WILMINGTON, DELAWARE
19801-3537
WWW.WILMINGTONDE.GOV

September 18, 2014

Mr. Anthony E. Hummel, P.E.
DNREC -Division of Water Resources
Surface Water Discharges Section
89 Kings Highway
Dover, Delaware 19901

RE: Discovery of a Dry Weather Overflow at CSO 12
NPDES Permit #DE0020320

Dear Mr. Hummel:

This letter serves as a formal notification regarding the City's recent discovery of a combined sewer overflow at CSO 12 on Wednesday, September 17, 2014. CSO 12 is located at the foot of French Street (see attached map). The overflow was discovered by our CSO Supervisor, Matt Copeland at 11:25 a.m. on Wednesday. Upon observance of the dry weather overflow the CSO Supervisor had the crew perform a confined space entry and removed the blockage which resolved the dry weather overflow by 12:58 p.m.

The City remains committed to preventing dry weather overflows through the daily inspection of CSO regulators and outfalls by the CSO crew. The regulator and outfall for CSO 12 are inspected three times a week. The last inspection prior to the dry weather overflow was conducted earlier in the day on Wednesday, September 17th at 9:50 am. During the inspection the flow was observed to be slow so the crew performed an additional inspection later in the day and found the overflow.

If you have any additional questions regarding this incident, please call me at (302) 576-2556. Also, if you would like to tour the site I would be happy to schedule a site visit to this location.

Sincerely,

Mary Neutz
Mary Neutz
Environmental Programs Manager

cc: Glenn Davis, DNREC (via e-mail)
Jeff Starkey, Public Works Commissioner (via e-mail)
Sean Duffy, Water Division Director, Public Works (via e-mail)
Bryan Lennon, Assistant Water Division Director, Public Works (via e-mail)
Kara Coats, First Assistant City Solicitor, City Solicitor's Office (via e-mail)
Aleksey Reznik, Project Manager, Veolia (via e-mail)

COMBINED SEWER OVERFLOW
LONG TERM CONTROL PLAN
FOR THE
CITY OF BOONVILLE

MAYOR

Pam Hendrickson

CITY COUNCIL

Dennis Shreve
Robert Canada
Jim Ruff
Robert Barnett
Ron Tubbs

BOARD OF PUBLIC WORKS

Dennis Shreve

CLERK-TREASURER

Nancy Shull

Veolia Water/BOONVILLE

Shawn Wright

ATTORNEY

Mark Phillips
Boonville, Indiana

December, 2002

REVISED: February, 2006

COMBINED SEWER OVERFLOW
LONG TERM CONTROL PLAN
FOR THE
CITY OF BOONVILLE

REPLACED

update

MAYOR

Pam Hendrickson

CITY COUNCIL

William Yockey
Robert Canada
Jim Ruff
Robert Barnett
Ron Tubbs

BOARD OF PUBLIC WORKS

Dennis Shreve

CLERK-TREASURER

Dixie Sulawske

U.S. FILTER/BOONVILLE

Rob Burton

ATTORNEY

Mark Phillips
Boonville, Indiana

December, 2002

Revised February 2006

Midwestern Engineers Inc.

Quality Engineering Services Since 1959

Consultants • Mechanical • Electrical • Civil

DAVID L. DAHL, P.E.
MICHAEL J. MATHIAS, P.E.
RICHARD A. BURCH, P.E.

GREGORY A. MANGIN, P.E.
JOHN W. WETZEL, P.E.

EMERITUS
ROBERT J. ELLIOTT, P.E.
ARTHUR R. BODDY, P.E.
JAMES E. BURCH, P.E.
WM. DALE MEYER, P.E.

December 31, 2002

Honorable Pam Hendrickson, Mayor
City of Boonville
133 South 2nd Street
P.O. Box 585
Boonville, IN 47601

RE: Long Term Control Plan
MEI Project No. 200025-06

Dear Mayor Hendrickson:

We are pleased to submit for your approval the Final Draft of Boonville's Combined Sewer Overflow Lonr Control Plan. It has been a pleasure working with you, U.S. Filter/Boonville Manager Rob Burton, and Citizens Committee members Ron Tubbs, Steve Byers and Robert Stone. The LTCP incorporates the concerns and advic Committee and the knowledge and expertise of the City's employees. All parties have labored hard to come to vitn this issue. We extend our gratitude to all involved.

All parties agree that in the past the City's CSO's have had an adverse impact on Cypress Creek. Recent improvements to both CSO basins and the new WWTP have greatly reduced this impact. It is now probable that sources other than the CSO's have a greater impact on the creek.

As discussed in the plan, additional improvements will be difficult and expensive. The financial impact will be substantial and widespread. The plan proposes a nearly 10 year implementation schedule, which will require IDEM's approval and appropriate changes to the City's NPDES limits.

We make the following recommendations:

1. Adopt L.T.C.P.
2. Retain rate accountant to review implementation schedule, and report on rate impact and available funding alternative (i.e. stormwater surcharge, rate increases and the like).
3. Submit L.T.C.P. to IDEM.
4. Adopt changes in CSO Operation Plan to reflect L.T.C.P.
5. Meet with IDEM to negotiate implementation schedule and agreed order.

Should you have any questions, please advise.

Sincerely,

MIDWESTERN ENGINEERS, INC.

David L. Dahl, P.E.
Senior Project Engineer

DLD/mlb

Enclosures

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

APPENDICES

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

APPENDICES

Replaced 3-28-06

DEFINITIONS

"Affected Public", includes the residential and business rate payers and users of the sewer system, persons who reside in municipalities that are downstream from the CSOs that could be affected by CSOs, persons who use and enjoy these waters, user organizations (such as fishing and boating clubs, conservation groups, etc.), and residents and businesses that would be affected by any construction associated with CSO abatement project implementation.

"Combined Sewage", refers to a combination of wastewater (including domestic, commercial, or industrial wastewater) and storm water transported in a combined sewer or combined sewer system.

"Combined Sewer", means a sewer that is designed, constructed, and used to receive and transport combined sewage.

"Combined Sewer Operational Plan", means a plan that contains the minimum technology controls applicable to, and requirements for operation and maintenance of, a combined sewer system.

"Combined Sewer System", means a system of combined sewers that:

(1) is designed, constructed, and used to receive and transport combined sewage to a publicly owned wastewater treatment plant; and

(2) may contain one (1) or more overflow points that discharge combined sewage entering the publicly owned wastewater treatment works when the hydraulic capacity of the system or part of the system is exceeded as a result of a wet weather event.

"Control Alternative", means any of the following measures, or any combination of the following measures, for the control of wet weather flows in a combined sewer system:

(1) Source controls.
(2) Collection system controls.
(3) Storage technologies.
(4) Treatment technologies.

"CSO", means Combined Sewer Overflow.

"CSO Impact Elimination", includes (1) the elimination of the CSO impacts through treatment of the discharge or pollution prevention, or (2) the removal, disconnection, plugging or other permanent mean of preventing a discharge from a CSO outfall.

"Designated Uses", are those uses specified in water quality standards for each water body or segment whether or not they are being attained.

"Existing Use", means a use actually attained in the water body on or after November 28, 1975, whether or not it is included in the water quality standards.

"First Flush", means the transport of solids in a combined sewer system that:

(1) have settled in pipes during periods between wet weather events; and

(2) have washed off of impermeable surfaces such as streets and parking lots during the beginning of a wet weather event.

"Full Body Contact Recreation", means swimming and other activities that potentially involve total body immersion. Such activities include, but are not limited to, SCUBA diving, snorkeling, water skiing, and ceremonial uses.

"Hydraulic Model", means a technically acceptable method for assessing the hydraulic response of a combined sewer system to a specific rainfall/runoff event, by quantifying the total volume of discharge and/or peak rate of discharge from one or more CSO points that result from control alternatives ranging from "doing nothing" to "complete CSO elimination".

"Knee of the Curve", the point where the incremental change in the cost of the control alternative per change in performance of the control alternative changes most rapidly.

"Long Term Control Plan", means a plan that:

(1) is consistent with the federal Combined Sewer Overflow Control Policy (59 Fed.Reg.18688);

(2) is developed in accordance with the recommendations set forth in Combined Sewer Overflows Guidance for Long Term Control Plan (EPA 832B95002);

(3) describes changes and improvements to be made to a combined sewer system or to a publicly owned wastewater treatment plant for the purpose of meeting the requirements of the federal Clean Water Act and state law;

(4) is developed with public participation using a process that is designed to promote active involvement by the affected public, through opportunities to provide in the decision making to select long term control alternatives:

- (A) information;
- (B) opinions; and
- (C) comments;

(5) is submitted to the department for approval; and

(6) considers the site-specific nature of combined sewer overflow discharges and does the following:

- (A) uses characterization, monitoring, and modeling of the combined sewer system to determine:
  - (i) the response of the combined sewer system to various precipitation events;
  - (ii) the characteristics of overflows from the combined sewer system; and
  - (iii) the water quality impacts that result from overflows from the combined sewer system;
- (B) considers the impact of combined sewer overflows on sensitive areas and gives highest priority to controlling overflows in those areas;
- (C) contains an evaluation of a reasonable range of control alternatives, taking into account expected and projected future growth;
- (D) contains cost and performance analyses of the control alternatives evaluated;
- (E) maximizes treatment of wet weather flows at a publicly owned treatment works (POTW) plant;
- (F) contains a practicable implementation schedule for the selected control alternative;
- (G) contains a post-construction compliance monitoring program adequate to ascertain:

(i) the effectiveness of the selected control alternative; and
(ii) the extent to which water quality standards have been attained.

"Sensitive Areas", means waters impacted by CSO discharges which must be given the highest priority for CSO discharge elimination, relocation, or control. Examples of sensitive areas include:

- Habitat for threatened or endangered species,
- Primary Contact Recreational Areas such as beaches and other swimming areas,
- Drinking Water Source Waters,
- Outstanding State Resource Waters and Outstanding National Resource Waters.

"Use Attainability Analysis", refers to a structured scientific assessment of the physical, chemical, biological, and economic factors affecting the attainment of a designated use as provided in 40 CFR 131.3(g).

"Water Quality Model", means a technically acceptable method for assessing the real-time and spatial impacts to the quality of a receiving water body resulting from point and non-point source external inputs of pollutants.

"Wet Weather Event", means storm water runoff, snow melt runoff, or ice melt runoff entering a combined sewer system.

"WWCPHI", means wastewater cost per household indicator using following formula:

$$\text{WWCPHI} = \frac{\dfrac{\text{Annualized LTCP + Existing Wastewater Cost}}{\text{Number of Households}}}{\text{Median Household Income}} \times 100\%$$

"SEIM", means Socio-Economic Indicators Matrix.

"S-E Indicator Matrix", same as SEIM.

"POTW", means Publicly Owned Treatment Works.

"MRO", means Monthly Report of Operation.

"MG/Year", means Million Gallons per Year.

"BOD", means Biological Oxygen Demand.

"TSS", means Total Suspended Solids.

LONG TERM
CONTROL PLAN

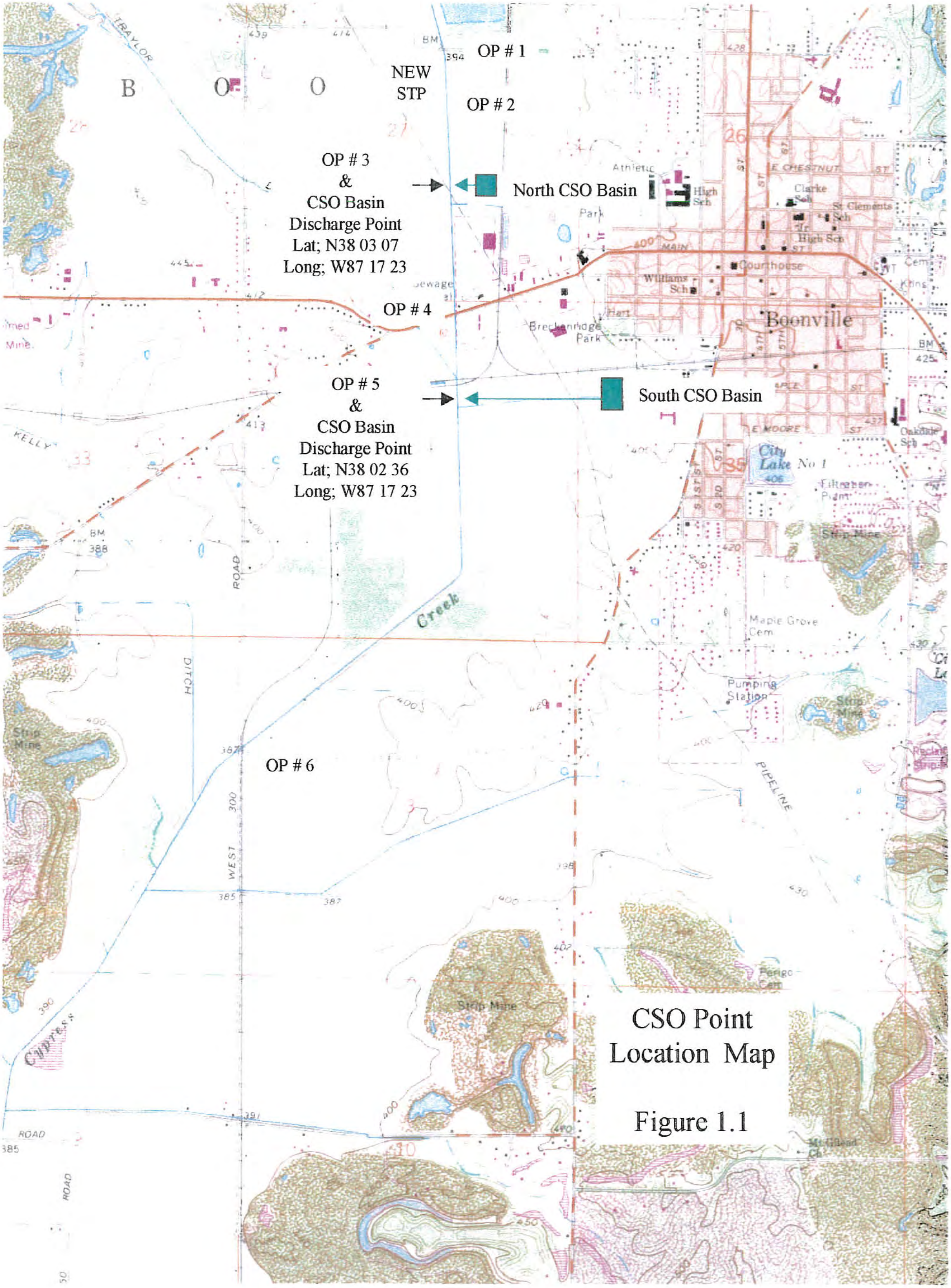
Section 1 - Consideration of Sensitive Areas

1-A Identification

The City of Boonville has two (2) CSO's. The location of the CSO's along with a photo are displayed in Figure 1.1. A complete description of each overflow is included in Section 3.

The North CSO (CSO 002) drains 690 acres and serves the northern portion of the City. Two (2) basins capture the first flush and provide primary settling to all discharged wastewater. After the storm passes and the plant is capable, the captured water is returned to the plant for treatment.

The South CSO (CSO 003) drains 660 acres and serves the southern portion of the City. Two (2) basins capture the first flush and provide primary settling to all discharged wastewater. After the storm passes and the plant is capable, the captured water is returned to the plant for treatment.



CSO Point Location Map

Figure 1.1

1-B Receiving Stream Sensitive Areas Identification & Documentation

The City of Boonville has one major receiving stream, Cypress Creek. To determine if this stream impacts any sensitive areas, the City established a Citizen Advisory Committee as discussed in Section 2. This Committee reviewed the following factors before making a recommendation to the City regarding Sensitive Areas.

1-B-1 Habitat for Threatened or Endangered Species

The US Fish and Wildlife Service was contacted and advised the City that the endangered Indiana Bat and the threatened Bald Eagle may have foraging Habitat in the project area. It was determined that the CSO's were not likely to adversely affect these listed species.

David's Copy REC'D NOV 27 2002

United States Department of the Interior

FISH AND WILDLIFE SERVICE

BLOOMINGTON FIELD OFFICE (ES)
620 South Walker Street
Bloomington, IN 47403-2121
(812) 334-4261 FAX (812) 334-4273

November 25, 2002

Mr. Brian Bullock
Midwestern Engineers, Inc.
P.O. Box 295
Loogootee, Indiana 47553-0295

Dear Mr. Bullock:

This responds to your letter of, 2002 requesting endangered species information from the U.S. Fish and Wildlife Service (FWS) for a combined sewer overflow (CSO) study for the town of Boonville in Warrick County, Indiana.

These comments have been prepared under the authority of the Fish and Wildlife Coordination Act (16 U.S.C. 661 et. seq.) and are consistent with the intent of the National Environmental Policy Act of 1969, the Endangered Species Act of 1973, and the U. S. Fish and Wildlife Service's Mitigation Policy.

The study area focuses on Cypress Creek. Attached is an excerpt from a National Wetland Inventory map depicting wetlands within the study area.

Endangered Species

Warrick County is within the range of the federally endangered Indiana bat (*Myotis sodalis*) and federally threatened bald eagle (*Haliaeetus leucocephalus*).

Indiana bats hibernate in caves, then disperse to reproduce and forage in relatively undisturbed forested areas associated with water resources during spring and summer. Young are raised in nursery colony roosts in trees, typically near forested drainageways in undeveloped areas.

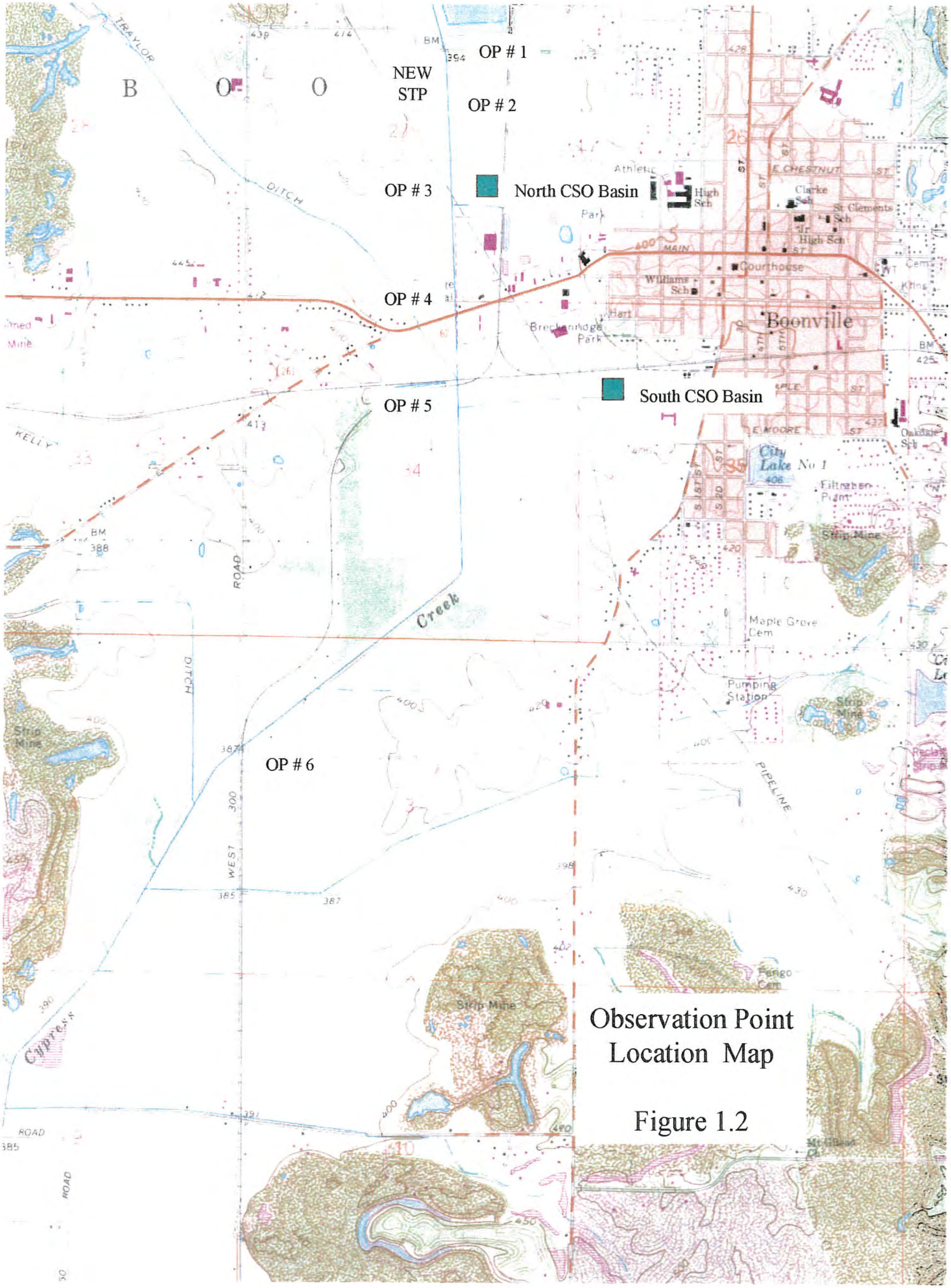
There are no caves in Warrick County, and no recent summer records of Indiana bats, however to our knowledge the county has not been thoroughly surveyed. There is suitable summer habitat for this species present in forested areas of the Cypress Creek corridor and its tributaries. If minor tree-clearing is proposed within suitable habitat, to avoid incidental take from removal of an occupied roost tree we recommend that tree-clearing be avoided during the period April 15 - September 15. If substantial tree-

1-B-2 Primary Contact Recreation Areas

The review of Cypress Creek located no public or private beaches. Being a dry weather stream of limited size, no water skiing, sailing, canoeing, kayaking, boating or fishing was found to occur anywhere in the 7 miles of stream located below Boonville. Figure 1.1 displays the location of the overflows. All of Cypress Creek flows through ground that has been zoned for, and is being utilized for, Agriculture.

No Schools are located along Cypress Creek. However, the Boonville High School and Jr. High Schools are located nearby. Both are separated from Cypress Creek by railroad tracks or a state highway.

The bed of Cypress Creek is privately owned and access is difficult due to steep banks and/or brush. Figures 1.3 through Figure 1.8 present a series of photographs showing the condition of Cypress Creek. Figures 1.2 is a map displaying the location of the areas photographed in Figures 1.3 thru 1.8.



Observation Point Location Map

Figure 1.2

Observation Point # 1

Above: Upstream view of Cypress Creek from County Road Bridge 200 feet east of New STP entrance.

Below: Downstream view from the same bridge. The right side of the photo shows the edge of the New STP property.

Figure 1.3

Observation Point # 2

Above: STP Effluent Outfall Structure into Cypress Creek

Below Left: Upstream view of Cypress Creek at the STP Outfall Structure

Below Right: Downstream view at same location.

Figure 1.4

Observation Point # 3

Above: Overflow pipe and channel from North CSO Basin. Confluence into Cypress Creek can be observed at bottom of photo. Creek flow is left to right.

Below Left and Right: Upstream and downstream view of Cypress Creek.

Figure 1.5

Observation Point # 4

Above: Upstream view of Cypress Creek as seen from the bridge on Hi-Way 62.

Below: Downstream view from the same observation point.

Figure 1.6

Observation Point # 5

Above: Headwall structure at discharge point from South CSO Basin. Overflow from the pond enters CypressCreek at this point. Creek confluence can be observed at bottom of photo flowing from left to right.

Below Left and Right: Upstream and downstream view of creek as observed from the same point.

Figure 1.7

Observation Point # 6

Above: Upstream view of Cypress Creek from bridge on Eskew Road, shown as CR 300 W. on map. This point is approximately 1.5 miles downstream from observation point # 5. The physical characteristics of this creek have been virtually the same at all observation points. Open farm fields border each side of the creek and the creek banks are steep and brush covered.

Below: Downstream view of creek from the same bridge.

Figure 1.8

1-B-3 Drinking Water Source Waters

Cypress Creek is not used as a drinking water source.

1-B-4 Outstanding State Resource Waters or Outstanding National Resource Waters

Cypress Creek is not listed as either an Outstanding State Resource Water and/or Outstanding National Resource Water. The copy of 327 IAC –2-1-2 which follows lists the State's OSRW. The City's CSO's do not impact either State or National Outstanding Resource Waters

AC 2-1-2 Maintenance of surface water quality standards
Authority: IC 13-14-8; IC 13-14-9; IC 13-18-3
Affected: IC 13-18-1; IC 13-18-4; IC 13-30-2-1

Sec. 2. The following policies of nondegradation are applicable to all surface waters of the state:
(1) For all waters of the state, existing beneficial uses shall be maintained and protected. No degradation of water quality shall be permitted which would interfere with or become injurious to existing and potential uses.
(2) All waters whose existing quality exceeds the standards established herein as of February 17, 1977, shall be maintained in their present high quality unless and until it is affirmatively demonstrated to the commissioner that limited degradation of such waters is justifiable on the basis of necessary economic or social factors and will not interfere with or become injurious to any beneficial uses made of, or presently possible, in such waters. In making a final determination under this subdivision, the commissioner shall give appropriate consideration to public participation and intergovernmental coordination.
(3) The following waters of high quality, as defined in subdivision (2), are designated by the board to be an outstanding state resource and shall be maintained in their present high quality without degradation:
(A) The Blue River in Washington, Crawford, and Harrison Counties, from river mile 57.0 to river mile 11.5.
(B) The North Fork of Wildcat Creek in Carroll and Tippecanoe Counties, from river mile 43.11 to river mile 4.82.
(C) The South Fork of Wildcat Creek in Tippecanoe County, from river mile 10.21 to river mile 0.00.
(4) Any determination made by the commissioner in accordance with Section 316 of the Clean Water Act concerning alternative thermal effluent limitations will be considered to be consistent with the policies enunciated in this section.
(Water Pollution Control Board; 327 IAC 2-1-2; filed Sep 24, 1987, 3:00 p.m.: 11 IR 579; filed Feb 1, 1990, 4:30 p.m.: 13 IR 1018; errata filed Jul 6, 1990, 5:00 p.m.: 13 IR 2003; filed Jan 14, 1997, 12:00 p.m.: 20 IR 1346)

1-C Establishing Type of CSO Controls in Sensitive Areas

The City of Boonville has determined that there are two Sensitive Areas near both CSO Basins. These are school facilities, though not directly impacted by the CSO's, they are in close proximity to the CSO basins. The City has established the following controls for these areas.

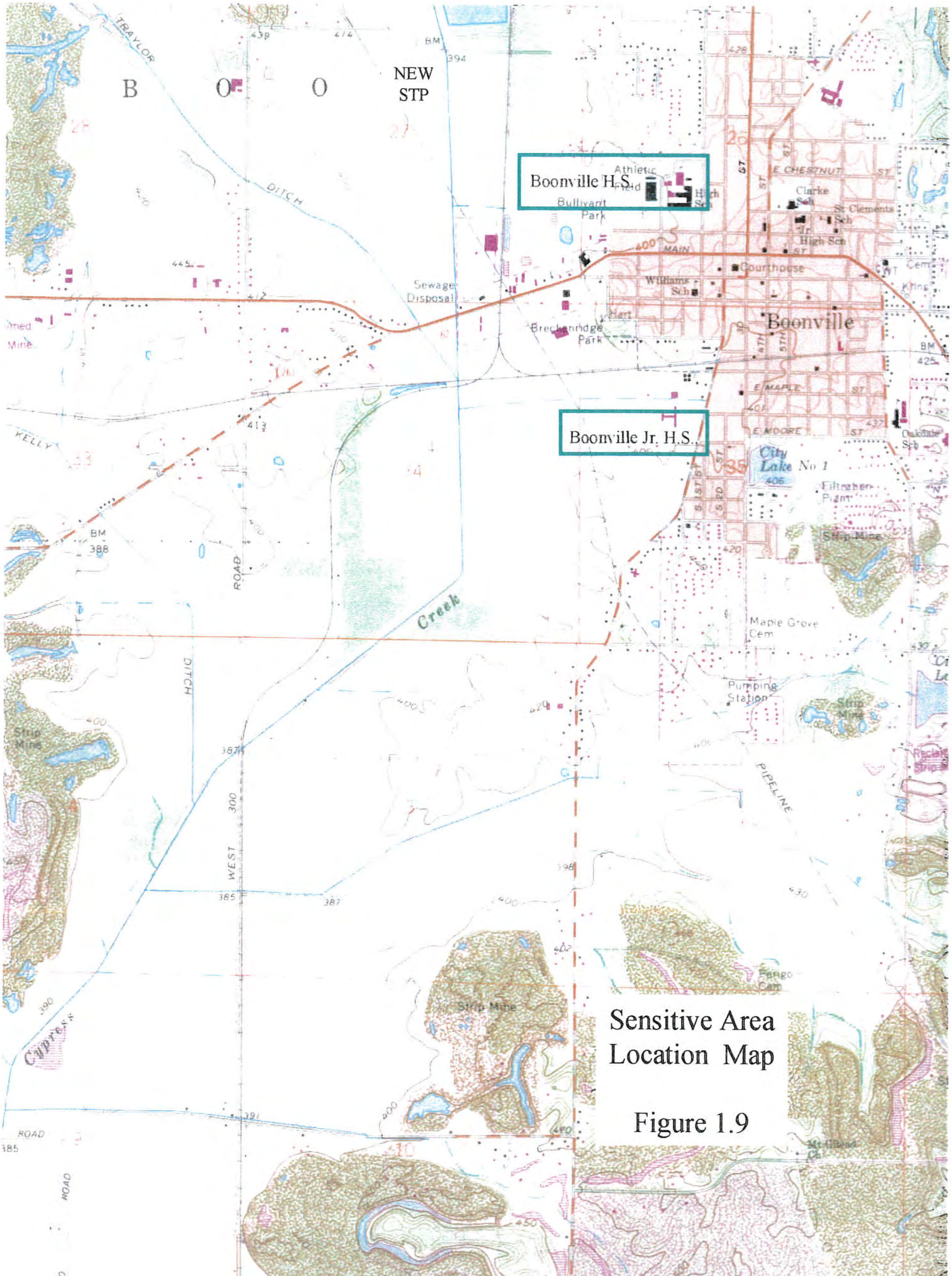
1. Maintain security fence.

2. Maintain storm culverts in area to reduce probabilities of flooding during storms.

3. Operate CSO Basins as efficiently as possible.

1-D Sensitive Area Documentation

The two areas deemed as sensitive are shown on Figure 1.9. In evaluating Sensitive Areas the City established a Citizens Advisory Committee (discussed in the Next Section). After discussion and evaluation, the CAC made a recommendation to the City Board of Works that two areas be deemed as sensitive. The Board concurred.



NEW
STP
Boonville H.S.
Boonville Jr. H.S.
Boonville
Athletic Field
Bullivant Park
Sewage Disposal
Breckenridge Park
Courthouse
Williams Sch
Clarke Sch
St Clements Sch
Jr High Sch
City Lake No 1
Filtration Plant
Maple Grove Cem
Pumping Station
Strip Mine
PIPELINE
DITCH
Creek
WEST 300 ROAD
Sensitive Area
Location Map

Figure 1.9

Section 2 - Public Participation

2-A Citizen Advisory Committees

The City of Boonville established a Citizens Advisory Committee. The Members were civic-minded individuals with some knowledge in the area of Utilities. The members and their association were;

Mr. Steve Byers – Boonville Fire Chief
Mr. Ron Tubbs – City Councilman, H.S. Coach
Mr. Rob Burton – Manager U.S. Filter/Boonville
Mr. Robert Stone – Downstream Property Owner and Cypress Creek Advocate

The Committee met to review preliminary information gathered by the City and the City's consultant. Based upon this information, and each committee member's knowledge and experience of the area, recommendations were made to the Board of Works. The meeting agendas, minutes and handouts are included in Appendix A. The Committee evaluated and made recommendations covering the following items.

- Determination of Sensitive Areas
- CSO Control options for Sensitive Areas
- LTCP alternatives to be considered
- Financial impact of Alternatives

Copies of the Committee's recommendation letter can be found in Appendix A

2-B Public Meetings and Hearings

Based upon input from the committee the City completed the Long Term Control Plan. The City Council held a public hearing to present and discuss the Sensitive Area Determination and the LTCP. Upon completion of the Hearing, the City accepted written comments for 10 days.

Once the comment period was closed all comments received were considered, and then adopted the Final LTCP was adopted.

The records of the public meeting and public Hearings are enclosed in Appendix A.

Section 3 - Characterization, Monitoring, and Modeling

3-A Rainfall Records

Draft IDEM CSO Treatment Facility Policy

In IDEM's Draft CSO Treatment Facility Policy, it is stated that for design purposes, the 10 year 1-hour storm and the 1 year 1-hour storm shall be used for design of CSO treatment facilities with retention and treatment of the flows generated by 1 year 1-hour storm and with primary treatment of flows up to the 10 year 1-hour storm, and treatment of flows in excess of the 10 year 1-hour storm to the maximum extent possible. For purposes of the Draft CSO Treatment Facility Policy, the 1 year 1-hour storm and the 10 year 1-hour storm shall be as defined in "Bulletin 71, Rainfall Frequency Atlas of the Midwest" using the "Huff Climatic Regions for Indiana Map." Copies of both publications follow. For Boonville, the storms to be used are:

1 year 1-hour	1.3 inches per hour
10 year 1-hour	2.19 inches per hour

Previous Rainfall Modeling Efforts in Boonville

Over the years, the Boonville system has been extensively studied and modeled. The efforts and the design storm used in each effort are discussed here.

1981-HNTB I/I Report — 1.1"/hour rain over 1 hr. 15 min. generated total overflow rate of 65 MGD with 7.3 MG at the North CSO at peak rate of 37 MGD and with 4.8 MG at the South CSO at peak rate of 28 MGD. Alternatives considered were designed using a 2 year 6-hour rainfall event.

1986-Triad Engineering, Inc. — Basin Design was in accordance with ISBH guidelines for a:

3 month 30 min. storm	0.70 inches
1 year 30 min. storm	0.95 inches
5 year 30 min. storm	1.39 inches

These storms were used to calculate the following storm volumes:

	N. CSO	S. CSO	Total
3 months	1.2 MG	1.5 MG	2.7 MG
1 year	1.7 MG	2.0 MG	3.7 MG
5 year	2.5 MG	3.0 MG	5.5 MG

The 3 month storm with 500,000 GPD pumpout was used to design ponds.

1993-Pitometer Assoc. — Study determined 1.5 inch rain produced 34 MGD rate at North CSO and 26 MGD rate at South CSO.

RAINFALL FREQUENCY ATLAS OF THE MIDWEST -- BULLETIN 71

Sectional Mean Frequency Distributions for Storm Periods of 5 Minutes to 10 Days and Recurrence Intervals of 2 Months to 100 Years in Indiana

Rainfall (inches) for given reccurrence interval

Section	Duration	2-Month	3-Month	4-Month	6-Month	9-Month	1-year	2-year	5-year	10-year	25-year	50-year	100-year
7	10-day	2.53	3.05	3.52	4.14	4.76	5..17	5.99	7.29	8.46	10.28	11.91	13.74
7	5-day	1.96	2.35	2.66	3.08	3.54	3.85	4.54	5.64	6.66	8.25	9.72	11.32
7	72-hr	1.80	2.11	2.39	2.77	3.18	3.46	4.10	5.12	6.02	7.49	8.79	10.28
7	48-hr	1.65	1.93	2.15	2.50	2.87	3.12	3.68	4.56	5.35	6.62	7.77	9.08
7	24-hr	1.52	1.77	1.93	2.24	2.54	2.76	3.27	4.00	4.65	5.66	6.52	7.47
7	18-hr	1.42	1.66	1.81	2.10	2.38	2.59	3.07	3.76	4.37	5.32	6.13	7.02
7	12-hr	1.32	1.54	1.68	1.94	2.21	2.40	2.84	3.48	4.05	4.92	5.67	6.50
7	6-hr	1.14	1.32	1.45	1.68	1.90	2.07	2.45	3.00	3.49	4.24	4.89	5.60
7	3-hr	0.97	1.13	1.24	1.43	1.63	1.77	2.09	2.56	2.98	3.62	4.17	4.78
7	2-hr	0.88	1.02	1.12	1.30	1.47	1.60	1.90	2.32	2.70	3.28	3.78	4.33
7	1-hr	0.71	0.83	0.91	1.05	1.20	1.30	1.54	1.88	2.19	2.66	3.06	3.51
7	30-min	0.56	0.65	0.71	0.83	0.94	1.02	1.21	1.48	1.72	2.09	2.41	2.76
7	15-min	0.41	0.48	0.52	0.61	0.69	0.75	0.88	1.08	1.26	1.53	1.76	2.02
7	10-min	0.32	0.37	0.41	0.47	0.53	0.58	0.69	0.84	0.98	1.19	1.37	1.57
7	5-min	0.18	0.21	0.23	0.27	0.30	0.33	0.39	0.48	0.56	0.68	0.78	0.90
8	10-day	2.39	2.88	3.32	3.90	4.49	4.88	5.74	6.95	7.99	9.60	11.04	12.64
8	5-day	1.90	2.27	2.57	2.98	3.42	3.72	4.50	5.54	6.43	7.71	8.88	10.18
8	72-hr	1.70	1.99	2.25	2.61	3.00	3.26	3.88	4.82	5.65	6.92	7.99	9.14
8	48-hr	1.61	1.88	2.10	2.43	2.80	3.04	3.61	4.41	5.13	6.18	7.14	8.13
8	24-hr	1.48	1.72	1.88	2.18	2.47	2.69	3.17	3.90	4.49	5.40	6.15	7.06
8	18-hr	1.39	1.62	1.77	2.05	2.33	2.53	2.98	3.67	4.22	5.08	5.78	6.64
8	12-hr	1.29	1.50	1.64	1.90	2.15	2.34	2.76	3.39	3.91	4.70	5.35	6.14
8	6-hr	1.11	1.29	1.41	1.64	1.86	2.02	2.38	2.93	3.37	4.05	4.61	5.30
8	3-hr	0.95	1.10	1.20	1.39	1.58	1.72	2.03	2.50	2.87	3.46	3.94	4.52
8	2-hr	0.86	1.00	1.09	1.26	1.44	1.56	1.84	2.26	2.60	3.13	3.57	4.09
8	1-hr	0.69	0.81	0.88	1.02	1.16	1.26	1.49	1.83	2.11	2.54	2.89	3.32
8	30-min	0.55	0.64	0.70	0.81	0.92	1.00	1.17	1.44	1.66	2.00	2.28	2.61
8	15-min	0.40	0.47	0.51	0.59	0.67	0.73	0.86	1.05	1.21	1.46	1.66	1.91
8	10-min	0.31	0.36	0.39	0.45	0.52	0.56	0.67	0.82	0.94	1.13	1.29	1.48
8	5-min	0.18	0.20	0.22	0.26	0.29	0.32	0.38	0.47	0.54	0.65	0.74	0.85

HUFF CLIMATIC REGIONS FOR INDIANA

REFERENCE
RAINFALL FREQUENCY ATLAS
OF THE MIDWEST
BULLETIN 71

STATE OF INDIANA
DEPARTMENT OF NATURAL RESOURCES
DIVISION OF WATER

INDIANA DEPARTMENT OF NATURAL RESOURCES

1997-Midwestern Engineers, Inc.	Master Plan prepared under Agreed Order 10 year return storm 0.70 in./hr. 4 hour duration (2.8 inch total) produced peak flow rate of 151 MGD North CSO and 140 MGD South CSO. 5 year return storm 0.66 in./hr. 4 hour duration (2.64 inch total) produced peak flow rate of 134 MGD North CSO and 116 MGD South CSO.

Review of City Rainfall Records

Rainfall records kept at the City's WWTP were evaluated and found to be similar to those kept by the National Weather Service. The table 3.A-1 displays the monthly frequency of various sized rainfalls for 1998 thru 2000. From this data it was determined that to capture or treat all but an average of 4 overflows per year it would be necessary to treat all storms up to 2" in size. Rainfall intensity data is not available from the WWTP. At Boonville every drop of water discharged at each CSO point passes through the CSO basins receiving a minimum of primary treatment.

CSO Flow Records

The WWTP maintains flow records for the plant as well as discharge records for both CSO basins. These records are shown in Table 3.A-2 and Table 3.A-2a. It should be noted that rainfall data and overflow data are taken at different times of day, therefore, rainfall and overflow events listed do not always appear on the same day. For the 12 months ending September 2002, total rainfall was 56.47" well in excess of the average rainfall of 47".

In October 2002 the City completed its new WWTP. This plant is designed to treat peak flows up to 9 MGD and average flows up to 5 MGD. Table 3.A-2a reflects the Flow Record for January 2003 thru December 2005 (monitoring data presented in Table 3.A-2). It is estimated that for the 12 months tabulated, the new plant would have greatly reduced overflows as follows.

	April 1996 - April 1997	2002 CSO Records	2005 CSO Records
Precipitation	Partial Record	56.47"	41.5"
WWTP Flow Treated		666 MG 11.8 MGD/inch	524 MG 12.3 MGD/inch
North CSO Discharge	202 MGD	217 MG 3.84 MGD/inch	66 MG 1.58 MGD/inch
South CSO Discharge	219 MGD	280 MG 4.9 MGD/inch	70 MG 1.68 MGD/inch

The size of storm leading to an overflow varies depending upon season and time after a previous rain. It is difficult to determine a trigger level rain.

One aspect of the new plant which has not been fully developed is its ability to handle additional flows. Review of recent MRO's indicates that a peak flow of 8.88 MGD was observed during a 4.5 inch rain on 11-15-2005, but a 0.85 inch rain on 11-28-2005 only reached a peak flow of 6.0 MGD, while a small overflow occurred. On 9-25-2005, a 0.8 inch rain produced a peak rate of 6.96 MGD, but a small overflow occurred. On 8-26-2005, a1.25 inch rain produced a peak flow of 6.72 MGD with a small overflow.

TABLE 3.A.-1
Rainfall frequency from Boonville MRO reports

	Days with Rain Greater than or Equal to 0.50"	Greater than or Equal to 1.00"	Greater than or Equal to 1.25"	Greater than or Equal to 1.5"	Greater than or Equal to 1.75"	Greater than 2"
January-98	1	0	0	0	0	0
February-98	1	0	0	0	0	0
March-98	2	0	0	0	0	0
April-98	4	2	2	2	1	1
May-98	3	1	0	0	0	0
June-98	9	4	2	2	1	1
July-98	3	3	0	0	0	0
August-98	3	1	1	1	0	0
September-98	0	0	0	0	0	0
October-98	3	1	1	0	0	0
November-98	2	1	1	0	0	0
December-98	4	2	2	2	1	1
98 TOTAL	35	15	9	7	3	3

	Days with Rain Greater than or Equal to 0.50"	Greater than or Equal to 1.00"	Greater than or Equal to 1.25"	Greater than or Equal to 1.5"	Greater than or Equal to 1.75"	Greater than 2"
January-99	4	3	1	1	1	1
February-99	0	0	0	0	0	0
March-99	5	2	1	0	0	0
April-99	4	2	2	0	0	0
May-99	3	1	1	1	0	0
June-99	6	2	0	0	0	0
July-99	1	0	0	0	0	0
August-99	1	0	0	0	0	0
September-99	0	0	0	0	0	0
October-99	1	1	1	1	1	1
November-99	0	0	0	0	0	0
December-99	4	0	0	0	0	0
99 TOTAL	29	11	6	3	2	2

	Days with Rain Greater than or Equal to 0.50"	Greater than or Equal to 1.00"	Greater than or Equal to 1.25"	Greater than or Equal to 1.5"	Greater than or Equal to 1.75"	Greater than 2"
January-00	2	1	1	1	1	1
February-00	5	3	2	2	1	1
March-00	2	1	1	0	0	0
April-00	1	1	0	0	0	0
May-00	1	0	0	0	0	0
June-00	5	2	2	1	1	0
July-00	2	2	2	2	1	1
August-00	5	3	1	1	1	0
September-00	4	1	1	0	0	0
October-00	0	0	0	0	0	0
November-00						
December-00						
00 TOTAL	27	14	10	7	5	3
TOTAL 1998 - 2000	91	40	25	17	10	8
Average/year	30	13	8	6	3	3

CSO FLOW DATA
OCTOBER, 2001 THRU SEPTEMBER, 2002

Date	Precipitation Inches	Influent Flow MGD	North CSO Overflow Volume MGD	South CSO Overflow Volume MGD
1-Oct-01		0.860		
2-Oct-01		0.830		
3-Oct-01		0.839		
4-Oct-01		0.863		
5-Oct-01	1.05	1.700		
6-Oct-01		1.566		
7-Oct-01		1.530		
8-Oct-01		1.413		
9-Oct-01		0.855		
10-Oct-01	0.07	1.450		
11-Oct-01	1.40	2.300	2.000	2.500
12-Oct-01	0.01	2.300		
13-Oct-01	1.13	2.250		
14-Oct-01	0.76	2.250	2.250	2.750
15-Oct-01	0.10	2.150		
16-Oct-01		2.050		
17-Oct-01		2.000		
18-Oct-01		1.650		
19-Oct-01		1.450		
20-Oct-01		1.150		
21-Oct-01		1.205		
22-Oct-01		1.496		
23-Oct-01	2.60	1.925	4.074	3.172
24-Oct-01	1.32	2.150	10.920	10.448
25-Oct-01		2.525	0.720	2.068
26-Oct-01		2.525		0.552
27-Oct-01		2.700		
28-Oct-01		2.450		
29-Oct-01		1.625		
30-Oct-01		1.400		
31-Oct-01		1.250		
Totals	8.440	52.707	19.964	21.490
Average		1.700	3.993	3.582
No. of Overflow days			5	6

Date	Precipitation Inches	Influent Flow MGD	North CSO Overflow Volume MGD	South CSO Overflow Volume MGD
1-Nov-01		1.100		
2-Nov-01	0.04	1.250		
3-Nov-01		1.366		
4-Nov-01		1.328		
5-Nov-01		1.299		
6-Nov-01		1.192		
7-Nov-01		1.214		
8-Nov-01		1.198		
9-Nov-01		1.254		
10-Nov-01		1.100		
11-Nov-01		1.124		
12-Nov-01		1.097		
13-Nov-01		1.244		
14-Nov-01		1.116		
15-Nov-01		1.126		
16-Nov-01		1.100		
17-Nov-01		1.113		
18-Nov-01		1.096		
19-Nov-01	0.29	1.650		
20-Nov-01		1.325		
21-Nov-01		1.103		
22-Nov-01		1.024		
23-Nov-01	0.01	1.043		
24-Nov-01	1.03	1.900	1.778	3.669
25-Nov-01		2.500		
26-Nov-01	0.37	2.700		
27-Nov-01	0.38	2.712	19.224	29.498
28-Nov-01	1.74	2.638		
29-Nov-01	1.3	2.400		
30-Nov-01	0.02	2.550		
Totals	5.18	44.862	21.002	33.167
Average		1.495	10.501	16.584
No. of Overflow Days			2	2

Date	Precipitation Inches	Influent Flow MGD	North CSO Overflow Volume MGD	South CSO Overflow Volume MGD
1-Dec-01		2.100		
2-Dec-01		2.000		
3-Dec-01		2.300		
4-Dec-01		2.350		
5-Dec-01		1.729		
6-Dec-01	0.7	0.556	5.316	4.682
7-Dec-01		2.400		
8-Dec-01	0.23	2.850		
9-Dec-01		2.400		
10-Dec-01		2.500		
11-Dec-01		2.300		
12-Dec-01	0.86	2.150	7.982	32.475
13-Dec-01	0.15	2.600		
14-Dec-01	0.37	2.653		
15-Dec-01		2.250		
16-Dec-01	2.37	2.400	12.122	
17-Dec-01	1.95	2.300		
18-Dec-01		2.500		
19-Dec-01	0.01	2.229		
20-Dec-01		2.159		
21-Dec-01		2.400		
22-Dec-01	0.46	2.400	0.950	3.711
23-Dec-01	0.08	2.325		
24-Dec-01		2.646		
25-Dec-01		2.402		
26-Dec-01		2.820		
27-Dec-01		2.400		
28-Dec-01		2.200		
29-Dec-01	0.01	1.822		
30-Dec-01		1.722		
31-Dec-01		1.710		
Totals	7.19	69.573	26.370	40.868
Average		2.244	6.593	13.623
No. of Overflow Days			4	3

Date	Precipitation Inches	Influent Flow MGD	North CSO Overflow Volume MGD	South CSO Overflow Volume MGD
1-Jan-02		1.597		1.500
2-Jan-02		1.594		1.010
3-Jan-02		1.570		0.500
4-Jan-02		1.447		
5-Jan-02		1.685		
6-Jan-02	0.26	1.176		
7-Jan-02		1.176		
8-Jan-02		1.610		
9-Jan-02		1.621		
10-Jan-02	0.01	1.573		
11-Jan-02		1.958		
12-Jan-02		1.697		
13-Jan-02		1.541		
14-Jan-02		1.445		
15-Jan-02		1.652		
16-Jan-02		1.395		
17-Jan-02		1.329		
18-Jan-02		1.677		
19-Jan-02	0.24	1.750		
20-Jan-02		1.535		
21-Jan-02		1.642		
22-Jan-02		1.615		
23-Jan-02	0.71	2.100	3.500	7.830
24-Jan-02	0.71	1.838	3.000	1.193
25-Jan-02		2.397	2.000	0.486
26-Jan-02		2.141	1.000	0.160
27-Jan-02		2.214		
28-Jan-02		2.310		
29-Jan-02		2.449		
30-Jan-02		1.865	4.500	4.750
31-Jan-02		2.315	3.500	3.250
Totals	1.93	53.914	17.500	20.679
Average		1.739	2.917	2.298
No. of Overflow Days			6	9

Date	Precipitation Inches	Influent Flow MGD	North CSO Overflow Volume MGD	South CSO Overflow Volume MGD
1-Feb-02		2.900	1.500	1.500
2-Feb-02		2.514		1.010
3-Feb-02		2.459		0.500
4-Feb-02		2.594		
5-Feb-02		2.500		
6-Feb-02	0.03	2.678		
7-Feb-02		2.573		
8-Feb-02		2.310		
9-Feb-02		2.350		
10-Feb-02	0.01	2.450		
11-Feb-02		2.050		
12-Feb-02		2.050		
13-Feb-02		1.972		
14-Feb-02		1.480		
15-Feb-02		2.788		
16-Feb-02		1.559		
17-Feb-02		1.417		
18-Feb-02		1.634		
19-Feb-02	0.31	2.000		
20-Feb-02	0.14	2.250		
21-Feb-02		1.900		
22-Feb-02		1.593		
23-Feb-02		1.450		
24-Feb-02		1.400		
25-Feb-02	0.44	1.595		
26-Feb-02	0.01	2.450		
27-Feb-02		2.687		
28-Feb-02		1.800		
Totals	0.94	59.403	1.5	3.01
Average		2.122	1.500	1.003
No. of Overflow Days			1	3

Date	Precipitation Inches	Influent Flow MGD	North CSO Overflow Volume MGD	South CSO Overflow Volume MGD
1-Mar-02		1.460		
2-Mar-02	0.92	2.250	2.297	3.702
3-Mar-02		2.250	0.252	1.795
4-Mar-02		2.425		0.472
5-Mar-02		2.450		
6-Mar-02		2.200		
7-Mar-02		2.000		
8-Mar-02		1.600		
9-Mar-02	0.86	2.240	0.829	3.375
10-Mar-02		2.200	0.006	1.605
11-Mar-02	0.11	2.200	0.005	0.952
12-Mar-02	0.01	2.500		0.580
13-Mar-02		2.415		0.002
14-Mar-02		2.250		
15-Mar-02	0.75	2.150	0.326	1.085
16-Mar-02		2.500	2.421	3.958
17-Mar-02	0.03	2.452	0.164	1.680
18-Mar-02	0.08	2.625	0.035	0.851
19-Mar-02	1.69	2.593	4.403	5.467
20-Mar-02	0.51	2.750	9.102	10.377
21-Mar-02		2.800	1.053	2.482
22-Mar-02		2.650	0.014	1.378
23-Mar-02		2.143		0.315
24-Mar-02	0.01	2.260		
25-Mar-02	1.31	2.900	3.046	5.164
26-Mar-02	0.31	2.725	9.791	8.664
27-Mar-02		2.500	1.004	2.437
28-Mar-02	0.01	3.000	0.011	0.857
29-Mar-02	0.36	2.800	0.089	2.175
30-Mar-02		2.600		1.072
31-Mar-02		2.725		0.178
Totals	6.96	74.613	34.848	60.623
Average		2.407	1.936	2.526
No. of Overflow Days			18	24

Date	Precipitation Inches	Influent Flow MGD	North CSO Overflow Volume MGD	South CSO Overflow Volume MGD
1-Apr-02		2.525		
2-Apr-02	0.16	2.500		
3-Apr-02		2.300		
4-Apr-02		2.300		
5-Apr-02		2.100		
6-Apr-02		2.300		
7-Apr-02		2.000		
8-Apr-02	0.36	2.000		
9-Apr-02	0.01	2.100		
10-Apr-02		2.300		
11-Apr-02		2.000		
12-Apr-02	0.50	2.754	1.014	6.412
13-Apr-02	1.32	2.100	10.223	10.076
14-Apr-02	2.11	2.100	6.500	5.000
15-Apr-02	0.03	2.325	3.200	2.500
16-Apr-02		2.700	1.000	0.750
17-Apr-02		2.500		
18-Apr-02		2.400		
19-Apr-02	0.78	2.561		
20-Apr-02	0.16	2.357	6.500	6.000
21-Apr-02	1.39	2.350	5.000	4.250
22-Apr-02		2.300	4.000	4.000
23-Apr-02		2.250	2.000	2.000
24-Apr-02	1.47	2.725	6.188	5.756
25-Apr-02		2.725	0.975	0.609
26-Apr-02		2.700	0.072	
27-Apr-02	1.19	2.334	5.944	8.967
28-Apr-02		2.506	1.435	2.740
29-Apr-02		2.500	0.039	
30-Apr-02		2.400	0.008	
Totals	9.48	71.012	54.098	59.06
Average		2.367	3.381	4.543
No. of Overflow Days			16	13

Date	Precipitation Inches	Influent Flow MGD	North CSO Overflow Volume MGD	South CSO Overflow Volume MGD
1-May-02	0.01	2.686		
2-May-02	0.43	2.600		
3-May-02		2.700		
4-May-02		2.715		
5-May-02	0.03	2.458		
6-May-02	0.51	2.799	4.616	4.500
7-May-02	0.64	2.659	0.318	1.000
8-May-02	0.16	2.701	4.386	5.000
9-May-02	0.04	2.570	0.581	1.000
10-May-02		2.447	0.100	0.500
11-May-02		2.000		0.050
12-May-02	1.27	2.600	1.227	1.750
13-May-02	0.32	2.647	6.222	7.000
14-May-02		2.947	1.186	1.250
15-May-02		2.814	0.059	0.750
16-May-02	0.16	2.924		
17-May-02	0.37	3.192		
18-May-02		2.869		2.000
19-May-02		2.741		1.000
20-May-02		2.592		
21-May-02		2.750		
22-May-02		2.425		
23-May-02		1.900		
24-May-02		1.525		
25-May-02		0.934		
26-May-02		1.400		
27-May-02		1.400		
28-May-02		1.658		
29-May-02	1.50	2.250	1.218	0.012
30-May-02		2.348	0.050	
31-May-02		2.320		
Totals	5.44	74.571	19.963	25.812
Average		2.406	1.815	1.986
No. of Overflow Days			11	13

Date	Precipitation Inches	Influent Flow MGD	North CSO Overflow Volume MGD	South CSO Overflow Volume MGD
1-Jun-02		1.801		
2-Jun-02		1.448		
3-Jun-02		1.363		
4-Jun-02	0.24	1.594		
5-Jun-02	0.11	2.000		
6-Jun-02	0.54	2.513	1.250	1.000
7-Jun-02		2.260		
8-Jun-02		2.057		
9-Jun-02		1.738		
10-Jun-02		1.342		
11-Jun-02	0.04	1.278		
12-Jun-02	0.15	1.390		
13-Jun-02	0.30	2.183		
14-Jun-02		1.810		
15-Jun-02		1.699		
16-Jun-02	0.02	1.315		
17-Jun-02	0.06	1.222		
18-Jun-02		1.129		
19-Jun-02		1.122		
20-Jun-02		1.120		
21-Jun-02		1.138		
22-Jun-02		1.131		
23-Jun-02		1.139		
24-Jun-02	0.01	1.175		
25-Jun-02	0.02	1.092		
26-Jun-02		0.858		
27-Jun-02	0.65	0.900		
28-Jun-02	0.45	1.800	1.500	1.250
29-Jun-02		1.751		
30-Jun-02		1.238		
Totals	2.59	44.606	2.750	2.250
Average		1.487	1.375	1.125
No. of Overflow Days			2	2

Date	Precipitation Inches	Influent Flow MGD	North CSO Overflow Volume MGD	South CSO Overflow Volume MGD
1-Jul-02		1.531		
2-Jul-02		1.507		
3-Jul-02		1.641		
4-Jul-02		1.242		
5-Jul-02		1.164		
6-Jul-02	0.04	1.184		
7-Jul-02		1.056		
8-Jul-02		1.052		
9-Jul-02	0.22	1.286		
10-Jul-02	0.10	1.215		
11-Jul-02		1.071		
12-Jul-02		1.015		
13-Jul-02		1.295		
14-Jul-02		1.038		
15-Jul-02		1.511		
16-Jul-02		1.063		
17-Jul-02	0.28	1.503		
18-Jul-02	1.42	1.762		
19-Jul-02		1.863		
20-Jul-02		1.862		
21-Jul-02		1.306		
22-Jul-02		1.123		
23-Jul-02	0.06	1.771		
24-Jul-02		1.239		
25-Jul-02		1.189		
26-Jul-02		1.209		
27-Jul-02		1.151		
28-Jul-02		1.093		
29-Jul-02		1.369		
30-Jul-02	0.33	1.164		
31-Jul-02		1.542		
Totals	2.45	41.017	0.000	0.000
Average		1.323		
No. of Overflow Days			0	0

Date	Precipitation Inches	Influent Flow MGD	North CSO Overflow Volume MGD	South CSO Overflow Volume MGD
1-Aug-02		1.226		
2-Aug-02		1.090		
3-Aug-02		1.111		
4-Aug-02		1.094		
5-Aug-02		1.094		
6-Aug-02		1.089		
7-Aug-02		0.552		
8-Aug-02		0.861		
9-Aug-02		1.114		
10-Aug-02		1.131		
11-Aug-02		1.105		
12-Aug-02		1.116		
13-Aug-02	0.35	1.500		
14-Aug-02	0.22	2.200		
15-Aug-02		1.591		
16-Aug-02		1.386		
17-Aug-02		1.159		
18-Aug-02		1.187		
19-Aug-02	0.10	1.200		
20-Aug-02		1.193		
21-Aug-02		1.158		
22-Aug-02		1.195		
23-Aug-02		1.400		
24-Aug-02	0.12	1.383		
25-Aug-02		1.139		
26-Aug-02		1.155		
27-Aug-02		1.132		
28-Aug-02		1.118		
29-Aug-02		1.110		
30-Aug-02		1.140		
31-Aug-02		1.241		
Totals	0.79	37.170	0.000	0.000
Average		1.199		
No. of Overflow Days			0	0

Date	Precipitation Inches	Influent Flow MGD	North CSO Overflow Volume MGD	South CSO Overflow Volume MGD
1-Sep-02		1.097		
2-Sep-02		1.122		
3-Sep-02		1.155		
4-Sep-02		1.166		
5-Sep-02		1.145		
6-Sep-02		1.143		
7-Sep-02		1.474		
8-Sep-02		1.100		
9-Sep-02		1.211		
10-Sep-02		1.150		
11-Sep-02		1.169		
12-Sep-02		1.124		
13-Sep-02		1.144		
14-Sep-02		1.310		
15-Sep-02	0.24	1.550		
16-Sep-02		1.100		
17-Sep-02	0.18	1.100		
18-Sep-02	0.65	1.376		
19-Sep-02	1.10	2.500	10.000	8.000
20-Sep-02	1.04	2.524	5.000	3.000
21-Sep-02	0.01	2.524	1.500	0.750
22-Sep-02		1.800	0.500	0.250
23-Sep-02		1.729		
24-Sep-02		1.093		
25-Sep-02		1.069		
26-Sep-02	1.82	2.000	2.000	1.500
27-Sep-02		1.700	0.500	0.300
28-Sep-02	0.04	1.700		
29-Sep-02		1.300		
30-Sep-02		1.300		
Totals	5.08	42.875	19.500	13.800
Average		1.429	3.250	2.300
No. of Overflow Days			6	6
YEAR TOTAL	56.47	666.323	217.495	280.759
YEAR TOTAL NO. OF OVERFLOW DAYS			71	81

TABLE 3.A - 2a

CSO FLOW DATA
JANUARY, 2003 THRU DECEMBER, 2005

Date	Precipitation Inches	Influent Flow MGD	North CSO Overflow Volume MGD	South CSO Overflow Volume MGD
1-Jan-03	0.46	4.34	0.75	0.65
2-Jan-03	0.10	3.96		
3-Jan-03	0.01	3.16		
4-Jan-03	0.01	3.02		
5-Jan-03		2.87		
6-Jan-03	0.01	2.09		
7-Jan-03		1.62		
8-Jan-03		1.56		
9-Jan-03		1.52		
10-Jan-03		1.23		
11-Jan-03		1.13		
12-Jan-03		1.14		
13-Jan-03		1.14		
14-Jan-03		1.14		
15-Jan-03		1.04		
16-Jan-03		1.09		
17-Jan-03		0.99		
18-Jan-03		1.01		
19-Jan-03		1.00		
20-Jan-03		0.99		
21-Jan-03		1.07		
22-Jan-03		0.95		
23-Jan-03		0.88		
24-Jan-03		0.89		
25-Jan-03	0.02	0.96		
26-Jan-03		0.93		
27-Jan-03		0.88		
28-Jan-03	0.05	0.97		
29-Jan-03	0.12	1.27		
30-Jan-03		1.01		
31-Jan-03	0.06	1.18		
Totals	0.840	47.03	0.75	0.65
Average		1.517	0.750	0.650
No. of Overflow days			1	1

TABLE 3.A - 2a

Date	Precipitation Inches	Influent Flow MGD	North CSO Overflow Volume MGD	South CSO Overflow Volume MGD
1-Feb-03		1.10		
2-Feb-03		0.99		
3-Feb-03	0.23	1.46		
4-Feb-03		1.34		
5-Feb-03		0.96		
6-Feb-03	0.05	1.03		
7-Feb-03	0.03	1.06		
8-Feb-03	0.02	0.99		
9-Feb-03		0.99		
10-Feb-03	0.20	1.35		
11-Feb-03		1.39		
12-Feb-03		1.05		
13-Feb-03		1.08		
14-Feb-03	0.98	2.65		
15-Feb-03	0.39	4.15	0.06	2.86
16-Feb-03		3.37		0.36
17-Feb-03	0.01	2.97		0.02
18-Feb-03	0.22	3.07		0.03
19-Feb-03	0.90	4.24		1.87
20-Feb-03	0.34	4.74	0.08	3.09
21-Feb-03	0.22	4.85	0.22	3.65
22-Feb-03	1.11	5.20	8.78	14.99
23-Feb-03	0.26	4.27	0.37	2.44
24-Feb-03	0.06	4.31		1.07
25-Feb-03	0.03	3.83		0.16
26-Feb-03	0.02	3.46	0.06	0.01
27-Feb-03	0.06	3.04	0.08	
28-Feb-03	0.03	3.29		
Totals	5.16	72.23	9.65	30.55
Average		2.580	1.379	2.546
No. of Overflow Days			7	12

TABLE 3.A - 2a

Date	Precipitation Inches	Influent Flow MGD	North CSO Overflow Volume MGD	South CSO Overflow Volume MGD
1-Mar-03		3.32		
2-Mar-03		3.09		
3-Mar-03		2.86		
4-Mar-03		2.63		
5-Mar-03	0.02	2.27		
6-Mar-03		1.96		
7-Mar-03		1.95		
8-Mar-03		1.77		
9-Mar-03		1.57		
10-Mar-03		1.55		
11-Mar-03		1.58		
12-Mar-03	0.14	2.10		
13-Mar-03	0.29	2.73		
14-Mar-03		2.20		
15-Mar-03		1.68		
16-Mar-03		1.49		
17-Mar-03		1.51		
18-Mar-03	0.01	1.40		
19-Mar-03	0.61	2.74	0.40	1.32
20-Mar-03	0.24	2.92		0.09
21-Mar-03	0.01	3.18		0.10
22-Mar-03		3.12		
23-Mar-03		2.01		
24-Mar-03		1.56		
25-Mar-03	0.31	3.88		
26-Mar-03	0.01	2.33		
27-Mar-03		1.65		
28-Mar-03	0.62	2.13		0.10
29-Mar-03	0.01	3.65		0.08
30-Mar-03		2.94		
31-Mar-03		1.99		
Totals	2.27	71.76	0.40	1.69
Average		2.315	6.593	13.623
No. of Overflow Days			1	5

TABLE 3.A - 2a

Date	Precipitation Inches	Influent Flow MGD	North CSO Overflow Volume MGD	South CSO Overflow Volume MGD
1-Apr-03		1.93		
2-Apr-03		1.46		
3-Apr-03		1.35		
4-Apr-03	0.15	1.53		
5-Apr-03		1.49		
6-Apr-03	0.40	1.69		
7-Apr-03	0.15	2.84		
8-Apr-03	0.02	1.83		
9-Apr-03	0.45	2.73		
10-Apr-03		2.80		
11-Apr-03		2.44		
12-Apr-03		1.62		
13-Apr-03		1.38		
14-Apr-03		1.40		
15-Apr-03		1.28		
16-Apr-03	0.09	1.22		
17-Apr-03	0.86	3.72		
18-Apr-03	0.01	2.93		
19-Apr-03		2.36		
20-Apr-03	0.13	2.08		
21-Apr-03	0.03	1.48		
22-Apr-03	0.01	1.28		
23-Apr-03	0.01	1.21		
24-Apr-03	0.07	1.21		
25-Apr-03	0.69	3.80	0.24	1.39
26-Apr-03	0.02	2.98		0.01
27-Apr-03		2.69		
28-Apr-03	0.28	2.40	0.44	0.81
29-Apr-03	0.01	3.45	0.02	0.17
30-Apr-03		3.10		
Totals	3.38	63.68	0.70	2.38
Average		2.123	0.233	0.595
No. of Overflow Days			3	4

TABLE 3.A - 2a

Date	Precipitation Inches	Influent Flow MGD	North CSO Overflow Volume MGD	South CSO Overflow Volume MGD
1-May-03	0.30	2.55		
2-May-03		1.69		
3-May-03		1.39		
4-May-03	1.65	1.94		0.15
5-May-03	0.30	4.45	4.75	6.50
6-May-03	0.40	3.30	0.02	0.21
7-May-03	0.10	3.94	0.14	2.00
8-May-03		3.03		0.31
9-May-03		2.46		0.07
10-May-03	0.06	2.03		0.03
11-May-03	0.25	2.48		0.27
12-May-03		2.24		
13-May-03		2.04		
14-May-03		1.46		
15-May-03	0.52	1.94		
16-May-03	0.28	1.75		
17-May-03	3.30	3.70	13.40	26.40
18-May-03	0.15	3.67	2.59	1.90
19-May-03		3.38	0.21	0.55
20-May-03	0.20	3.11		0.40
21-May-03		2.86		0.01
22-May-03		2.88		
23-May-03		2.34		
24-May-03		1.53		
25-May-03	0.70	2.30		
26-May-03		2.85		
27-May-03		2.47		
28-May-03	0.25	1.88		
29-May-03		2.13		
30-May-03		1.70		
31-May-03	0.05	1.29		
Totals	8.51	76.78	21.11	38.80
Average		2.477	3.518	2.985
No. of Overflow Days			6	13

Date	Precipitation Inches	Influent Flow MGD	North CSO Overflow Volume MGD	South CSO Overflow Volume MGD
1-Jun-03		1.16		
2-Jun-03	0.63	1.52		
3-Jun-03	0.12	2.96		0.23
4-Jun-03		2.17		
5-Jun-03		1.32		
6-Jun-03		1.24		
7-Jun-03		1.19		
8-Jun-03		1.19		
9-Jun-03		1.35		
10-Jun-03	0.60	2.11		
11-Jun-03	1.70	3.79	0.25	2.14
12-Jun-03		4.12	1.26	3.90
13-Jun-03		3.49		0.06
14-Jun-03		2.70		
15-Jun-03		2.06		
16-Jun-03		1.50		
17-Jun-03		1.47		
18-Jun-03		1.23		
19-Jun-03		1.17		
20-Jun-03		1.07		
21-Jun-03		1.02		
22-Jun-03		0.96		
23-Jun-03		0.95		
24-Jun-03		0.90		
25-Jun-03		0.90		
26-Jun-03	0.60	1.82		1.05
27-Jun-03		2.16		
28-Jun-03		1.29		
29-Jun-03		0.74		
30-Jun-03		1.01		
Totals	3.65	50.56	1.51	7.38
Average		1.685	0.755	1.476
No. of Overflow Days			2	5

TABLE 3.A - 2a

Date	Precipitation Inches	Influent Flow MGD	North CSO Overflow Volume MGD	South CSO Overflow Volume MGD
1-Jul-03		0.88		
2-Jul-03		0.86		
3-Jul-03		0.84		
4-Jul-03		0.80		
5-Jul-03		0.82		
6-Jul-03		1.07		
7-Jul-03		0.83		
8-Jul-03	0.40	1.10		
9-Jul-03	0.25	2.12		
10-Jul-03		1.14		
11-Jul-03		0.78		
12-Jul-03		0.77		
13-Jul-03		0.77		
14-Jul-03		0.77		
15-Jul-03	0.65	1.21		0.53
16-Jul-03		2.29		
17-Jul-03		1.44		
18-Jul-03		0.85		
19-Jul-03		0.79		
20-Jul-03		0.76		
21-Jul-03	1.00	2.40		0.74
22-Jul-03		2.09		
23-Jul-03		1.59		
24-Jul-03		0.80		
25-Jul-03		0.54		
26-Jul-03		0.05		
27-Jul-03		1.08		
28-Jul-03		1.14		
29-Jul-03		0.73		
30-Jul-03		0.70		
31-Jul-03		2.36		
Totals	2.30	34.37	0.00	1.27
Average		1.109	0.000	0.635
No. of Overflow Days			0	2

TABLE 3.A - 2a

Date	Precipitation Inches	Influent Flow MGD	North CSO Overflow Volume MGD	South CSO Overflow Volume MGD
1-Aug-03		1.78		
2-Aug-03	0.70	2.96		0.64
3-Aug-03	0.25	2.20		
4-Aug-03		1.34		
5-Aug-03		0.88		
6-Aug-03		0.81		
7-Aug-03		0.77		
8-Aug-03		0.74		
9-Aug-03		0.73		
10-Aug-03		0.72		
11-Aug-03	0.10	0.73		
12-Aug-03		0.70		
13-Aug-03		0.71		
14-Aug-03		0.71		
15-Aug-03		0.70		
16-Aug-03		0.73		
17-Aug-03		0.80		
18-Aug-03		0.72		
19-Aug-03		0.73		
20-Aug-03		0.72		
21-Aug-03		0.73		
22-Aug-03		0.68		
23-Aug-03		0.69		
24-Aug-03		0.68		
25-Aug-03		0.92		
26-Aug-03		0.69		
27-Aug-03		0.71		
28-Aug-03		0.68		
29-Aug-03		0.67		
30-Aug-03	0.35	1.03		
31-Aug-03	0.35	1.05		
Totals	1.75	28.71	0.00	0.64
Average		0.926	0.000	0.640
No. of Overflow Days			0	1

TABLE 3.A - 2a

Date	Precipitation Inches	Influent Flow MGD	North CSO Overflow Volume MGD	South CSO Overflow Volume MGD
1-Sep-03	0.45	1.16		
2-Sep-03	0.45	1.70		0.26
3-Sep-03		1.38		0.26
4-Sep-03		0.79		
5-Sep-03		0.71		
6-Sep-03		0.68		
7-Sep-03		0.91		
8-Sep-03		1.21		
9-Sep-03		0.83		
10-Sep-03		0.68		
11-Sep-03		0.64		
12-Sep-03		0.64		
13-Sep-03		0.65		
14-Sep-03		0.69		
15-Sep-03		0.65		
16-Sep-03		0.64		
17-Sep-03		0.66		
18-Sep-03		0.64		
19-Sep-03		0.61		
20-Sep-03		0.61		
21-Sep-03	0.30	0.85		
22-Sep-03	0.90	2.88		0.45
23-Sep-03		1.69		
24-Sep-03		0.72		
25-Sep-03		0.68		
26-Sep-03	0.30	0.66		
27-Sep-03	0.20	2.06		
28-Sep-03	0.10	0.95		
29-Sep-03		0.72		
30-Sep-03	0.10	1.15		
Totals	2.80	28.84	0.00	0.97
Average		0.961	0.000	0.323
No. of Overflow Days			0	3

TABLE 3.A - 2a

Date	Precipitation Inches	Influent Flow MGD	North CSO Overflow Volume MGD	South CSO Overflow Volume MGD
1-Oct-03		1.07		
2-Oct-03		0.72		
3-Oct-03		0.69		
4-Oct-03		0.66		
5-Oct-03		0.67		
6-Oct-03		0.67		
7-Oct-03		0.65		
8-Oct-03		0.65		
9-Oct-03	0.25	0.92		
10-Oct-03	0.15	1.00		
11-Oct-03		0.70		
12-Oct-03		0.70		
13-Oct-03		0.97		
14-Oct-03	0.75	1.85		0.10
15-Oct-03		1.14		
16-Oct-03	0.20	1.11		
17-Oct-03		2.33		
18-Oct-03		0.95		
19-Oct-03		0.72		
20-Oct-03		0.69		
21-Oct-03		0.66		
22-Oct-03		0.65		
23-Oct-03		0.65		
24-Oct-03		0.61		
25-Oct-03		1.03		
26-Oct-03	0.20	1.76		
27-Oct-03	0.40	0.79		
28-Oct-03	0.15	1.44		
29-Oct-03		1.22		
30-Oct-03		0.68		
31-Oct-03		0.65		
Totals	2.10	29.00	0.00	0.10
Average		0.935	0.000	0.100
No. of Overflow Days			0	1

TABLE 3.A - 2a

Date	Precipitation Inches	Influent Flow MGD	North CSO Overflow Volume MGD	South CSO Overflow Volume MGD
1-Nov-03		0.65		
2-Nov-03		0.67		
3-Nov-03		0.68		
4-Nov-03		0.66		
5-Nov-03		0.64		
6-Nov-03		0.85		
7-Nov-03		0.63		
8-Nov-03		0.63		
9-Nov-03		0.62		
10-Nov-03		0.65		
11-Nov-03		0.74		
12-Nov-03		2.27		
13-Nov-03		1.17		
14-Nov-03		0.78		
15-Nov-03		1.31		
16-Nov-03		0.78		
17-Nov-03		0.78		
18-Nov-03		3.21		0.48
19-Nov-03		2.68	0.06	0.11
20-Nov-03		1.86		
21-Nov-03		0.92		
22-Nov-03		0.83		
23-Nov-03		1.60		0.40
24-Nov-03		3.29		0.73
25-Nov-03		2.42		
26-Nov-03		1.37		
27-Nov-03		3.18		0.69
28-Nov-03		3.04		0.25
29-Nov-03		2.50		
30-Nov-03		1.66		
Totals	0.00	43.07	0.06	2.66
Average		1.436	0.060	0.443
No. of Overflow Days			1	6

TABLE 3.A - 2a

Date	Precipitation Inches	Influent Flow MGD	North CSO Overflow Volume MGD	South CSO Overflow Volume MGD
1-Dec-03		1.09		
2-Dec-03		0.97		
3-Dec-03		0.82		
4-Dec-03		1.53		
5-Dec-03	0.40	1.74		
6-Dec-03		0.98		
7-Dec-03		0.98		
8-Dec-03		1.17		
9-Dec-03		1.25		
10-Dec-03		1.50		
11-Dec-03		1.05		
12-Dec-03		0.91		
13-Dec-03		0.90		
14-Dec-03		1.19		
15-Dec-03		1.17		
16-Dec-03		1.57		
17-Dec-03	0.10	1.19		
18-Dec-03		1.31		
19-Dec-03		1.15		
20-Dec-03		0.93		
21-Dec-03		0.90		
22-Dec-03	0.25	0.94		
23-Dec-03		1.41		
24-Dec-03		0.99		
25-Dec-03		0.87		
26-Dec-03		0.88		
27-Dec-03		0.87		
28-Dec-03		0.85		
29-Dec-03	0.60	2.24		
30-Dec-03		1.96		
31-Dec-03		1.30		
Totals	1.35	36.61	0.00	0.00
Average		1.181	0.000	0.000
No. of Overflow Days			0	0
YEAR TOTAL	34.11	582.64	34.18	87.09
YEAR TOTAL NO. OF OVERFLOW DAYS			21	53

TABLE 3.A - 2a

Date	Precipitation Inches	Influent Flow MGD	North CSO Overflow Volume MGD	South CSO Overflow Volume MGD
1-Jan-04	0.20	1.46		
2-Jan-04	1.20	3.85	1.28	0.21
3-Jan-04	0.50	3.31		0.09
4-Jan-04	0.50	4.26	1.05	0.91
5-Jan-04		3.86		0.09
6-Jan-04		2.54		
7-Jan-04		2.21		
8-Jan-04		1.73		
9-Jan-04		1.23		
10-Jan-04		1.24		
11-Jan-04		1.22		
12-Jan-04		1.14		
13-Jan-04		1.02		
14-Jan-04		1.04		
15-Jan-04		1.04		
16-Jan-04		0.86		
17-Jan-04		1.90		
18-Jan-04	0.25	2.65		0.19
19-Jan-04		1.84		
20-Jan-04		1.86		
21-Jan-04		1.28		
22-Jan-04		1.12		
23-Jan-04		1.13		
24-Jan-04		1.08		
25-Jan-04		1.17		
26-Jan-04		1.84		
27-Jan-04	0.50	2.12		0.02
28-Jan-04		2.10		
29-Jan-04		2.28	0.02	
30-Jan-04		1.48	0.02	
31-Jan-04		1.28	0.06	
Totals	3.150	57.14	2.43	1.51
Average		1.843	0.486	0.252
No. of Overflow days			5	6

TABLE 3.A - 2a

Date	Precipitation Inches	Influent Flow MGD	North CSO Overflow Volume MGD	South CSO Overflow Volume MGD
1-Feb-04				
2-Feb-04				
3-Feb-04				
4-Feb-04				
5-Feb-04				
6-Feb-04				
7-Feb-04				
8-Feb-04				
9-Feb-04				
10-Feb-04				
11-Feb-04				
12-Feb-04				
13-Feb-04				
14-Feb-04				
15-Feb-04				
16-Feb-04				
17-Feb-04				
18-Feb-04				
19-Feb-04				
20-Feb-04				
21-Feb-04				
22-Feb-04				
23-Feb-04				
24-Feb-04				
25-Feb-04				
26-Feb-04				
27-Feb-04				
28-Feb-04				
29-Feb-04				
Totals				
Average				
No. of Overflow Days				

TABLE 3.A - 2a

Date	Precipitation Inches	Influent Flow MGD	North CSO Overflow Volume MGD	South CSO Overflow Volume MGD
1-Mar-04	0.30	1.79		
2-Mar-04		1.08		
3-Mar-04	1.00	2.21	0.17	0.70
4-Mar-04	0.20	3.27	0.09	0.46
5-Mar-04	0.20	2.49		0.16
6-Mar-04		2.35		
7-Mar-04		2.18		
8-Mar-04		1.60		
9-Mar-04		1.63		
10-Mar-04		1.64		
11-Mar-04		1.27		
12-Mar-04		1.10		
13-Mar-04		1.03		
14-Mar-04		1.03		
15-Mar-04	0.50	1.51		
16-Mar-04		2.44		
17-Mar-04		2.04		
18-Mar-04		1.40		
19-Mar-04		1.11		
20-Mar-04	0.70	2.71	0.53	1.51
21-Mar-04	0.80	2.99		0.33
22-Mar-04		2.77		
23-Mar-04		2.43		
24-Mar-04		1.66		
25-Mar-04		1.36		
26-Mar-04		1.32		
27-Mar-04		1.43		
28-Mar-04		1.23		
29-Mar-04	0.30	1.87		
30-Mar-04	0.25	2.14		0.26
31-Mar-04		1.68		
Totals	4.25	56.76	0.79	3.42
Average		1.831	6.593	13.623
No. of Overflow Days			3	6

Date	Precipitation Inches	Influent Flow MGD	North CSO Overflow Volume MGD	South CSO Overflow Volume MGD
1-Apr-04		2.02		
2-Apr-04		1.42		
3-Apr-04		1.22		
4-Apr-04		1.43		
5-Apr-04		1.56		
6-Apr-04		1.18		
7-Apr-04		1.09		
8-Apr-04		1.02		
9-Apr-04		0.92		
10-Apr-04	0.15	0.98		
11-Apr-04		0.95		
12-Apr-04		1.09		
13-Apr-04	0.50	1.65		
14-Apr-04		1.50		
15-Apr-04		1.31		
16-Apr-04		0.95		
17-Apr-04		0.87		
18-Apr-04		0.86		
19-Apr-04		0.97		
20-Apr-04		0.89		
21-Apr-04		0.87		
22-Apr-04	0.90	2.07		0.17
23-Apr-04	0.30	3.49		0.48
24-Apr-04	0.40	2.70		0.14
25-Apr-04		3.14		0.24
26-Apr-04		2.50		
27-Apr-04		1.76		
28-Apr-04		1.31		
29-Apr-04		1.12		
30-Apr-04	0.50	1.94		
Totals	2.75	44.78	0.00	1.03
Average		1.493	0.000	0.258
No. of Overflow Days			0	4

TABLE 3.A - 2a

Date	Precipitation Inches	Influent Flow MGD	North CSO Overflow Volume MGD	South CSO Overflow Volume MGD
1-May-04	0.35	2.87		0.50
2-May-04	0.10	3.12		0.31
3-May-04	0.20	2.86		0.12
4-May-04		2.19		0.07
5-May-04		1.67		0.04
6-May-04		1.33		
7-May-04		1.16		
8-May-04		1.06		
9-May-04		0.99		
10-May-04		0.98		
11-May-04		0.99		
12-May-04	0.30	1.15		
13-May-04	0.60	3.13		2.37
14-May-04	0.50	3.55		1.38
15-May-04	0.75	4.98		3.34
16-May-04		3.84		0.18
17-May-04		3.37		0.89
18-May-04		2.68		0.05
19-May-04		2.24		
20-May-04		2.24		
21-May-04		1.65		
22-May-04		1.31		
23-May-04		1.17		
24-May-04		1.13		
25-May-04	1.40	2.33	1.15	16.22
26-May-04	1.40	4.16	4.50	11.47
27-May-04	1.50	4.05	2.00	4.33
28-May-04	0.50	3.72	0.10	0.37
29-May-04	0.60	3.23		
30-May-04		3.75		1.33
31-May-04		3.76		0.67
Totals	8.20	76.66	7.75	43.64
Average		2.473	1.938	2.567
No. of Overflow Days			4	17

TABLE 3.A - 2a

Date	Precipitation Inches	Influent Flow MGD	North CSO Overflow Volume MGD	South CSO Overflow Volume MGD
1-Jun-04		2.89		
2-Jun-04		2.50		
3-Jun-04		2.02		
4-Jun-04		1.38		
5-Jun-04		1.29		
6-Jun-04		1.18		
7-Jun-04		1.10		
8-Jun-04		1.04		
9-Jun-04		1.01		
10-Jun-04		0.99		
11-Jun-04		0.95		
12-Jun-04		1.20		
13-Jun-04		1.37		
14-Jun-04		1.10		
15-Jun-04		0.88		
16-Jun-04		1.35		
17-Jun-04		1.07		
18-Jun-04		1.22		
19-Jun-04		1.00		
20-Jun-04		0.81		
21-Jun-04		0.83		
22-Jun-04		0.81		
23-Jun-04		0.78		
24-Jun-04		0.80		
25-Jun-04		0.79		
26-Jun-04		0.75		
27-Jun-04		0.75		
28-Jun-04		0.76		
29-Jun-04		0.99		
30-Jun-04		0.96		
Totals	0.00	34.57	0.00	0.00
Average		1.152	0.000	0.000
No. of Overflow Days			0	0

TABLE 3.A - 2a

Date	Precipitation Inches	Influent Flow MGD	North CSO Overflow Volume MGD	South CSO Overflow Volume MGD
1-Jul-04		0.73		
2-Jul-04		0.73		
3-Jul-04		0.85		
4-Jul-04		0.80		
5-Jul-04		0.95		
6-Jul-04	0.25	1.07		
7-Jul-04	0.43	2.03		0.05
8-Jul-04		1.45		
9-Jul-04		0.78		
10-Jul-04		1.18		
11-Jul-04		1.21		
12-Jul-04	0.60	1.52		
13-Jul-04		2.25	1.50	2.37
14-Jul-04	1.00	2.51		
15-Jul-04		1.71		
16-Jul-04		0.91		
17-Jul-04	0.50	1.00		
18-Jul-04		0.68		
19-Jul-04		0.87		
20-Jul-04		0.96		
21-Jul-04		0.77		
22-Jul-04	0.50	1.58		0.26
23-Jul-04		2.06		
24-Jul-04		1.11		
25-Jul-04		0.92		
26-Jul-04	0.10	0.85		
27-Jul-04		0.85		
28-Jul-04		0.73		
29-Jul-04		0.71		
30-Jul-04		0.86		
31-Jul-04	0.10	0.86		
Totals	3.48	35.49	1.50	2.68
Average		1.145	1.500	0.893
No. of Overflow Days			1	3

TABLE 3.A - 2a

Date	Precipitation Inches	Influent Flow MGD	North CSO Overflow Volume MGD	South CSO Overflow Volume MGD
1-Aug-04		0.78		
2-Aug-04		0.74		
3-Aug-04		0.70		
4-Aug-04		0.69		
5-Aug-04		0.68		
6-Aug-04		0.64		
7-Aug-04		0.65		
8-Aug-04		0.67		
9-Aug-04		0.67		
10-Aug-04		0.66		
11-Aug-04		0.64		
12-Aug-04		0.65		
13-Aug-04		0.67		
14-Aug-04		0.60		
15-Aug-04		0.64		
16-Aug-04		0.66		
17-Aug-04		0.66		
18-Aug-04		0.75		
19-Aug-04		0.65		
20-Aug-04	0.20	1.10		
21-Aug-04		0.65		
22-Aug-04		0.66		
23-Aug-04	0.25	0.68		
24-Aug-04		0.90		
25-Aug-04		0.93		
26-Aug-04	2.50	3.18		4.74
27-Aug-04		1.16		
28-Aug-04		1.26		
29-Aug-04	0.10	1.68		
30-Aug-04		1.71		
31-Aug-04		1.06		
Totals	3.05	27.77	0.00	4.74
Average		0.896	0.000	4.740
No. of Overflow Days			0	1

TABLE 3.A - 2a

Date	Precipitation Inches	Influent Flow MGD	North CSO Overflow Volume MGD	South CSO Overflow Volume MGD
1-Sep-04		0.79		
2-Sep-04		0.73		
3-Sep-04		0.69		
4-Sep-04		0.70		
5-Sep-04		0.66		
6-Sep-04		0.73		
7-Sep-04		0.76		
8-Sep-04		0.70		
9-Sep-04		0.69		
10-Sep-04		0.65		
11-Sep-04		0.66		
12-Sep-04		0.68		
13-Sep-04		0.68		
14-Sep-04	1.35	2.26		0.64
15-Sep-04		1.49		
16-Sep-04		1.49		
17-Sep-04		1.01		
18-Sep-04		0.92		
19-Sep-04		0.80		
20-Sep-04		0.76		
21-Sep-04		0.81		
22-Sep-04		0.71		
23-Sep-04		0.69		
24-Sep-04		0.65		
25-Sep-04		0.65		
26-Sep-04		0.66		
27-Sep-04		0.75		
28-Sep-04		0.75		
29-Sep-04		0.73		
30-Sep-04		0.63		
Totals	1.35	24.88	0.00	0.64
Average		0.829	0.000	0.640
No. of Overflow Days			0	1

TABLE 3.A - 2a

Date	Precipitation Inches	Influent Flow MGD	North CSO Overflow Volume MGD	South CSO Overflow Volume MGD
1-Oct-04		0.60		
2-Oct-04		0.61		
3-Oct-04		0.62		
4-Oct-04		0.68		
5-Oct-04		0.58		
6-Oct-04		0.59		
7-Oct-04		0.59		
8-Oct-04		0.61		
9-Oct-04		0.59		
10-Oct-04		0.57		
11-Oct-04		0.59		
12-Oct-04	0.25	1.47		
13-Oct-04	1.00	1.49		
14-Oct-04		1.16		
15-Oct-04	0.50	1.59		
16-Oct-04		0.79		
17-Oct-04		0.69		
18-Oct-04	0.56	3.08	0.25	0.30
19-Oct-04	1.50	1.99	2.00	2.25
20-Oct-04		1.52	0.75	0.85
21-Oct-04		1.39		
22-Oct-04		1.22		
23-Oct-04		1.82		
24-Oct-04	0.68	1.40		
25-Oct-04		1.13		
26-Oct-04	0.87	1.44		
27-Oct-04	0.87	2.37	2.50	3.00
28-Oct-04	0.18	2.65	1.50	2.15
29-Oct-04	0.15	1.94	0.85	1.50
30-Oct-04	0.25	2.27	0.50	0.75
31-Oct-04	0.50	1.74	0.20	0.40
Totals	7.31	39.78	8.55	11.20
Average		1.283	1.069	1.400
No. of Overflow Days			8	8

TABLE 3.A - 2a

Date	Precipitation Inches	Influent Flow MGD	North CSO Overflow Volume MGD	South CSO Overflow Volume MGD
1-Nov-04	1.25	2.89		
2-Nov-04		3.61		
3-Nov-04	0.20	2.48		
4-Nov-04	0.16	2.26		
5-Nov-04		2.32		
6-Nov-04		1.65		
7-Nov-04		1.27		
8-Nov-04		1.13		
9-Nov-04		1.05		
10-Nov-04		1.23		
11-Nov-04	2.20	3.20	1.50	1.00
12-Nov-04		3.83	0.50	0.23
13-Nov-04		3.26		
14-Nov-04		2.48		
15-Nov-04		1.48		
16-Nov-04		1.35		
17-Nov-04		1.32		
18-Nov-04	0.55	1.73		
19-Nov-04		2.35		
20-Nov-04		2.17		
21-Nov-04		1.95		
22-Nov-04	0.18	2.08		
23-Nov-04	0.10	1.53		
24-Nov-04	0.20	2.97		
25-Nov-04		2.48		
26-Nov-04		1.56		
27-Nov-04		2.22		
28-Nov-04	0.50	2.50		
29-Nov-04		2.79		
30-Nov-04	0.25	3.64		
Totals	5.59	66.78	2.00	1.23
Average		2.226	1.000	0.615
No. of Overflow Days			2	2

Date	Precipitation Inches	Influent Flow MGD	North CSO Overflow Volume MGD	South CSO Overflow Volume MGD
1-Dec-04		2.71		
2-Dec-04		2.17		
3-Dec-04		1.94		
4-Dec-04		1.75		
5-Dec-04	0.20	1.76		
6-Dec-04		2.50		
7-Dec-04	0.70	4.17		
8-Dec-04		3.36		
9-Dec-04		2.84		
10-Dec-04		2.04		
11-Dec-04	0.25	1.63		
12-Dec-04		1.47		
13-Dec-04		1.38		
14-Dec-04		1.68		
15-Dec-04		1.33		
16-Dec-04		1.16		
17-Dec-04		1.10		
18-Dec-04		1.10		
19-Dec-04		1.01		
20-Dec-04		1.02		
21-Dec-04		1.00		
22-Dec-04		1.36		
23-Dec-04		1.16		
24-Dec-04		1.15		
25-Dec-04		1.15		
26-Dec-04		1.23		
27-Dec-04		1.27		
28-Dec-04	0.58	1.48		
29-Dec-04	0.50	3.18	2.00	2.25
30-Dec-04	0.50	4.71	1.00	1.50
31-Dec-04	0.75	4.57	1.50	2.00
Totals	3.48	60.38	4.50	5.75
Average		1.948	1.500	1.917
No. of Overflow Days			3	3
YEAR TOTAL	42.61	524.99	27.52	75.84
YEAR TOTAL NO. OF OVERFLOW DAYS			26	51

TABLE 3.A - 2a

Date	Precipitation Inches	Influent Flow MGD	North CSO Overflow Volume MGD	South CSO Overflow Volume MGD
1-Jan-05	0.10	4.49	0.03	0.02
2-Jan-05	0.10	3.97		
3-Jan-05	1.05	4.44	0.13	0.12
4-Jan-05	0.25	3.95	0.11	0.07
5-Jan-05	0.80	4.42	0.25	0.23
6-Jan-05		4.20	0.89	0.20
7-Jan-05		3.70		
8-Jan-05	0.40	3.53		
9-Jan-05		2.73	0.50	0.60
10-Jan-05	0.10	2.76	0.30	0.40
11-Jan-05	0.10	3.04		
12-Jan-05		2.52		
13-Jan-05	0.40	3.38	0.50	0.60
14-Jan-05	0.40	3.35	0.25	0.30
15-Jan-05		3.17		
16-Jan-05		2.64		
17-Jan-05		1.87		
18-Jan-05		1.48		
19-Jan-05		1.80		
20-Jan-05		1.43		
21-Jan-05		1.36		
22-Jan-05		1.27		
23-Jan-05		1.16		
24-Jan-05		1.18		
25-Jan-05		1.31		
26-Jan-05		1.33		
27-Jan-05		1.00		
28-Jan-05		1.00		
29-Jan-05		1.40		
30-Jan-05		1.12		
31-Jan-05	0.20	1.06		
Totals	3.900	76.06	2.96	2.54
Average		2.454	0.329	0.282
No. of Overflow days			9	9

TABLE 3.A - 2a

Date	Precipitation Inches	Influent Flow MGD	North CSO Overflow Volume MGD	South CSO Overflow Volume MGD
1-Feb-05		1.05		
2-Feb-05		1.20		
3-Feb-05	0.125	1.27		
4-Feb-05		1.09		
5-Feb-05		1.07		
6-Feb-05		1.04		
7-Feb-05	0.44	2.60	1.50	1.70
8-Feb-05	0.44	3.02	1.25	1.30
9-Feb-05		2.57	0.50	1.00
10-Feb-05		2.98		
11-Feb-05		2.16		
12-Feb-05		1.53		
13-Feb-05	0.37	3.01	1.25	1.50
14-Feb-05	0.50	3.84	0.75	0.80
15-Feb-05		3.50	0.45	0.50
16-Feb-05		2.85		
17-Feb-05		2.00		
18-Feb-05		1.82		
19-Feb-05		1.45		
20-Feb-05	0.20	1.94		
21-Feb-05		1.87		
22-Feb-05		1.62		
23-Feb-05		1.50		
24-Feb-05		1.73		
25-Feb-05		1.42		
26-Feb-05		1.34		
27-Feb-05		1.32		
28-Feb-05		1.74		
Totals	2.075	54.53	5.7	6.8
Average		1.948	0.95	1.133
No. of Overflow Days			6	6

TABLE 3.A - 2a

Date	Precipitation Inches	Influent Flow MGD	North CSO Overflow Volume MGD	South CSO Overflow Volume MGD
1-Mar-05		1.98		
2-Mar-05		1.47		
3-Mar-05		1.27		
4-Mar-05		1.20		
5-Mar-05		1.11		
6-Mar-05		1.12		
7-Mar-05	0.30	1.61		
8-Mar-05		1.24		
9-Mar-05		1.18		
10-Mar-05		1.15		
11-Mar-05		1.10		
12-Mar-05	0.10	1.13		
13-Mar-05		1.01		
14-Mar-05		1.02		
15-Mar-05		0.99		
16-Mar-05		0.98		
17-Mar-05		0.99		
18-Mar-05		0.94		
19-Mar-05		0.91		
20-Mar-05		0.90		
21-Mar-05		0.92		
22-Mar-05	0.20	1.45		
23-Mar-05	0.40	1.76		
24-Mar-05	0.40	1.47		
25-Mar-05		1.51		
26-Mar-05	0.10	1.77		
27-Mar-05	0.10	2.53		
28-Mar-05	1.50	3.86	1.75	1.50
29-Mar-05		2.42	0.50	0.35
30-Mar-05		2.56		
31-Mar-05	0.20	3.00		
Totals	3.30	46.55	2.25	1.85
Average		1.502	1.125	0.925
No. of Overflow Days			2	2

TABLE 3.A - 2a

Date	Precipitation Inches	Influent Flow MGD	North CSO Overflow Volume MGD	South CSO Overflow Volume MGD
1-Apr-05		2.33		
2-Apr-05	0.30	2.30	0.50	0.55
3-Apr-05		1.67		
4-Apr-05		2.09		
5-Apr-05		1.94		
6-Apr-05		1.47		
7-Apr-05	0.20	2.34		
8-Apr-05		2.04		
9-Apr-05		1.44		
10-Apr-05		1.37		
11-Apr-05	0.30	1.35		
12-Apr-05	0.40	2.69	1.50	1.50
13-Apr-05		2.15	0.75	0.80
14-Apr-05		2.53	0.50	0.55
15-Apr-05		2.50		
16-Apr-05		1.50		
17-Apr-05		1.29		
18-Apr-05		1.29		
19-Jan-05		1.17		
20-Apr-05		1.11		
21-Apr-05		1.07		
22-Apr-05	0.12	1.22		
23-Apr-05	0.12	1.00		
24-Apr-05		1.00		
25-Apr-05		1.00		
26-Apr-05	0.12	1.72		
27-Apr-05	0.40	1.69		
28-Apr-05		2.02		
29-Apr-05	0.18	1.89		
30-Apr-05	0.25	1.33		
Totals	2.39	50.51	3.25	3.40
Average		1.684	0.813	0.850
No. of Overflow Days			4	4

TABLE 3.A - 2a

Date	Precipitation Inches	Influent Flow MGD	North CSO Overflow Volume MGD	South CSO Overflow Volume MGD
1-May-05		1.64		
2-May-05		1.51		
3-May-05		1.00		
4-May-05		0.97		
5-May-05		0.94		
6-May-05		0.91		
7-May-05		0.90		
8-May-05		0.89		
9-May-05		0.90		
10-May-05		0.89		
11-May-05		0.86		
12-May-05		0.83	2.20	2.00
13-May-05	1.50	0.89	1.50	1.00
14-May-05		2.59	0.75	0.60
15-May-05		1.18	0.25	0.40
16-May-05		1.60		
17-May-05		1.72		
18-May-05		1.18		
19-May-05		1.35		
20-May-05	1.25	3.26	1.75	1.50
21-May-05		2.54	1.00	0.80
22-May-05		1.38	0.50	0.40
23-May-05		1.21		
24-May-05		0.99		
25-May-05		1.04		
26-May-05		0.91		
27-May-05		0.98		
28-May-05		1.15		
29-May-05		0.84		
30-May-05	0.13	0.86		
31-May-05		0.86		
Totals	2.88	38.77	7.95	6.70
Average		1.251	1.136	0.957
No. of Overflow Days			7	7

TABLE 3.A - 2a

Date	Precipitation Inches	Influent Flow MGD	North CSO Overflow Volume MGD	South CSO Overflow Volume MGD
1-Jun-05		0.91		
2-Jun-05	0.25	1.40		
3-Jun-05	0.10	0.92		
4-Jun-05		0.84		
5-Jun-05		0.82		
6-Jun-05		0.82		
7-Jun-05		0.79		
8-Jun-05		0.81		
9-Jun-05		0.75		
10-Jun-05	1.03	1.24	1.50	1.75
11-Jun-05	0.10	0.81	1.00	1.20
12-Jun-05	2.20	3.20	0.75	0.75
13-Jun-05		2.37	0.50	0.62
14-Jun-05		2.47	0.10	0.10
15-Jun-05		1.43		
16-Jun-05		0.98		
17-Jun-05		0.92		
18-Jun-05		0.86		
19-Jun-05		0.82		
20-Jun-05		0.84		
21-Jun-05		0.83		
22-Jun-05		0.81		
23-Jun-05		0.81		
24-Jun-05		0.88		
25-Jun-05		0.75		
26-Jun-05		0.74		
27-Jun-05		0.78		
28-Jun-05		0.78		
29-Jun-05		0.84		
30-Jun-05		0.77		
Totals	3.68	31.99	3.85	4.42
Average		1.066	0.770	0.884
No. of Overflow Days			5	5

TABLE 3.A - 2a

Date	Precipitation Inches	Influent Flow MGD	North CSO Overflow Volume MGD	South CSO Overflow Volume MGD
1-Jul-05		0.73		
2-Jul-05		0.69		
3-Jul-05		0.67		
4-Jul-05		1.02		
5-Jul-05	0.75	0.81		
6-Jul-05		1.43		
7-Jul-05		1.57		
8-Jul-05		0.72		
9-Jul-05		0.71		
10-Jul-05		0.71		
11-Jul-05		1.49		
12-Jul-05	0.60	2.42		
13-Jul-05	0.75	2.32	2.00	2.25
14-Jul-05		2.54	1.25	1.85
15-Jul-05	0.37	1.57	0.75	1.00
16-Jul-05		1.14	0.30	0.30
17-Jul-05		0.90		
18-Jul-05	2.50	1.44		
19-Jul-05	0.20	1.96	1.50	1.75
20-Jul-05		1.07	0.50	0.75
21-Jul-05		0.92		
22-Jul-05	0.75	2.52		
23-Jul-05		1.77		
24-Jul-05		0.98		
25-Jul-05		1.03		
26-Jul-05		0.87		
27-Jul-05		0.84		
28-Jul-05		0.84		
29-Jul-05		0.78		
30-Jul-05		0.74		
31-Jul-05		0.76		
Totals	5.92	37.96	6.30	7.90
Average		1.225	1.050	1.317
No. of Overflow Days			6	6

TABLE 3.A - 2a

Date	Precipitation Inches	Influent Flow MGD	North CSO Overflow Volume MGD	South CSO Overflow Volume MGD
1-Aug-05		0.78		
2-Aug-05		0.81		
3-Aug-05		0.82		
4-Aug-05		0.8		
5-Aug-05		0.72		
6-Aug-05		0.72		
7-Aug-05		0.73		
8-Aug-05		0.84		
9-Aug-05		0.96		
10-Aug-05		0.79		
11-Aug-05		0.77		
12-Aug-05		0.79		
13-Aug-05		0.73		
14-Aug-05	0.31	0.94		
15-Aug-05		0.8		
16-Aug-05	0.25	1.22		
17-Aug-05		0.81		
18-Aug-05	0.2	1.82		
19-Aug-05		1.4		
20-Aug-05		1.11		
21-Aug-05		0.78		
22-Aug-05		0.76		
23-Aug-05		0.73		
24-Aug-05		0.73		
25-Aug-05		0.75		
26-Aug-05	1.25	3.25	2.00	2.00
27-Aug-05	0.8	2.65	0.75	0.75
28-Aug-05	0.2	1.71	0.30	0.30
29-Aug-05	0.1	1.14		
30-Aug-05	1.25	3.59		
31-Aug-05	1.25	3.02	2.25	2.25
Totals	5.61	37.47	5.30	5.30
Average		1.209	1.325	1.325
No. of Overflow Days			4	4

TABLE 3.A - 2a

Date	Precipitation Inches	Influent Flow MGD	North CSO Overflow Volume MGD	South CSO Overflow Volume MGD
1-Sep-05		2.83		
2-Sep-05		2.18		
3-Sep-05		1.38		
4-Sep-05		1.2		
5-Sep-05		1.19		
6-Sep-05		1.34		
7-Sep-05		1.25		
8-Sep-05		1.13		
9-Sep-05		0.86		
10-Sep-05		0.68		
11-Sep-05		0.72		
12-Sep-05		0.69		
13-Sep-05		0.89		
14-Sep-05		0.44	0.13	
15-Sep-05		1.37	0.13	
16-Sep-05		1.23		
17-Sep-05		0.7		
18-Sep-05		0.73		
19-Sep-05	0.8	0.75		
20-Sep-05		2.55	0.02	
21-Sep-05		1.76		
22-Sep-05		0.79		
23-Sep-05		0.76		
24-Sep-05		0.75		
25-Sep-05		1.73		
26-Sep-05	0.6	1.75		
27-Sep-05		1.44		
28-Sep-05		1.09		
29-Sep-05	0.25	1.28		
30-Sep-05		0.79		
Totals	1.65	36.25	0.28	
Average		1.208	0.093	
No. of Overflow Days			3	0

TABLE 3.A - 2a

Date	Precipitation Inches	Influent Flow MGD	North CSO Overflow Volume MGD	South CSO Overflow Volume MGD
1-Oct-05		0.76		
2-Oct-05		0.79		
3-Oct-05		0.78		
4-Oct-05		0.76		
5-Oct-05		0.77		
6-Oct-05		0.74		
7-Oct-05		0.72		
8-Oct-05		0.7		
9-Oct-05		0.73		
10-Oct-05		0.74		
11-Oct-05		0.76		
12-Oct-05		0.71		
13-Oct-05		0.71		
14-Oct-05		0.73		
15-Oct-05		0.71		
16-Oct-05		0.71		
17-Oct-05		0.92		
18-Oct-05		0.65		
19-Oct-05		0.68		
20-Oct-05		1.05		
21-Oct-05	0.25	0.79		
22-Oct-05		0.67		
23-Oct-05	0.4	0.96		
24-Oct-05		0.68		
25-Oct-05		0.68		
26-Oct-05		0.66		
27-Oct-05		0.67		
28-Oct-05		0.79		
29-Oct-05		0.75		
30-Oct-05		0.71		
31-Oct-05	0.2	0.66		
Totals	0.85	23.14	0.00	0.00
Average		0.746		
No. of Overflow Days			0	0

TABLE 3.A - 2a

Date	Precipitation Inches	Influent Flow MGD	North CSO Overflow Volume MGD	South CSO Overflow Volume MGD
1-Nov-05		0.98		
2-Nov-05		0.82		
3-Nov-05		0.68		
4-Nov-05		0.68		
5-Nov-05		0.68		
6-Nov-05		0.85		
7-Jan-05	0.4	1.17		
8-Nov-05		0.71		
9-Nov-05		0.74		
10-Nov-05		0.74		
11-Nov-05		0.64		
12-Nov-05		0.66		
13-Nov-05	0.1	0.79		
14-Nov-05		1.48	0.01	0.01
15-Nov-05	4.5	5.71	27.62	29.00
16-Nov-05	1.5	2.98	0.26	1.50
17-Nov-05		2.99		0.50
18-Nov-05		2.9		
19-Nov-05		1.59		
20-Nov-05		1.19		
21-Nov-05		1.13		
22-Nov-05		1.07		
23-Nov-05		1.15		
24-Nov-05		0.95		
25-Nov-05		0.92		
26-Nov-05		1.18		
27-Nov-05		1.74		
28-Nov-05	0.85	2.84	0.13	0.13
29-Nov-05		2.4		
30-Nov-05		2.39		
Totals	7.35	44.75	28.02	31.14
Average		1.492	7.005	6.228
No. of Overflow Days			4	5

TABLE 3.A - 2a

Date	Precipitation Inches	Influent Flow MGD	North CSO Overflow Volume MGD	South CSO Overflow Volume MGD
1-Dec-05		1.8		
2-Dec-05		1.2		
3-Dec-05		1.2		
4-Dec-05		1.1		
5-Dec-05	0.2	1.01		
6-Dec-05		0.96		
7-Dec-05		0.91		
8-Dec-05		1.22		
9-Dec-05		1.31		
10-Dec-05		1.39		
11-Dec-05		1.77		
12-Dec-05		1.56		
13-Dec-05		1.23		
14-Dec-05	0.19	1.94		
15-Dec-05	0.31	3.06		
16-Dec-05		2.32		
17-Dec-05		1.29		
18-Dec-05		1.2		
19-Dec-05		1.14		
20-Dec-05		1.1		
21-Dec-05		1.05		
22-Dec-05		1.03		
23-Dec-05		1.06		
24-Dec-05		1.08		
25-Dec-05	0.5	2.46		
26-Dec-05	0.5	2.54		
27-Dec-05		1.58		
28-Dec-05	0.1	1.65		
29-Dec-05	0.1	1.39		
30-Dec-05		1.83		
31-Dec-05		2.05		
Totals	1.90	46.41	0.00	0.00
Average		1.497		
No. of Overflow Days			0	0
ANNUAL TOTAL	41.51	524.39	65.86	70.05
ANNUAL TOTAL NO. OF OVERFLOW DAYS			50	48

3-B Combined Sewer System Characterization

The City of Boonville's system includes two major combined sewer drainage basins and a smaller portion of newer separate sewers. The combined sewer systems are identified as the North CSO and the South CSO.

North CSO Basin

The northern portion of Boonville is served by a combined sewer system which terminates with an 84" brick sewer lying on the southside of Bullivant Park. Prior to 1987, a combined sewer diversion structure was located near the City's West Corporation Limits at the ball fields. A diversion dam in the invert of the 84" sewer diverted "dry weather" flows into a 15" sewer for conveyance to the WWTP. Flows which exceeded the capacity of the WWTP would discharge over the diversion into a drainage ditch approximately one half mile to Cypress Creek. In addition to the CSO discharge, this ditch drained surface water from over 200 acres of low lying ground west of Boonville, north of State Road 62 and east of the Railroad. Prior to 1987, approximately 440 acres were drained by the CSO Basin, including the 24" outlet pipe from a strip pit on Ninth Street which drains approximately 78 acres, and two inlets on Poplar which drain 15 acres each, and one inlet on Eighth Street which drains 13 acres. In the EPA funded project in 1987, an 84" CSO Extension was constructed from the diversion structure west to a two cell CSO Basin. The new pipe was laid in the flow line of the existing drainage ditch effectively enclosing the ditch from the corporate limits to the railroad tracks. In 1998 the City diverted the Dry Weather Flow from the strip pit to a location outside the CSO system.

The CSO Basin was designed to capture 1.12 MG of storm water in the Basin and 0.12 MG in the 84" sewer for a total volume of 1.24 MG for return to the treatment plant after a storm event. Volume based upon wier elevation of 387.4 ft. However, during operation, water level increases as water flows over the effluent wier. Volume is calculated to be 5 MG at 392 ft. This would include the "first flush" solids plus any additional solids which settle during a storm event. Return is by a 350 gpm Lift Station directly to the new force main to the plant.

Improvements constructed in 1998 included electric operators for the North CSO sluice gates and a transfer pump which gives the operator the capacity to transfer basin contents, thus maximizing the available basin storage. Figure 3.B-1 is a map displaying the North CSO Basin.

South CSO Basin

The southern portion of Boonville is served by a combined sewer system which terminates with an 84" brick sewer lying on the west side of Yankeetown Road south of the Railroad. Prior to 1987, a combined sewer diversion structure was located just west of Yankeetown Road. A diversion dam in the invert of the 84" sewer diverted "dry weather" flows into a 15" sewer for conveyance to the WWTP. Storm flows which exceeded the capacity of the WWTP would discharge over the diversion into a drainage

ditch which flowed one mile to Cypress Creek. In addition to the CSO discharge, this ditch drained surface water from several acres of low lying ground west of Yankeetown Road. Ground water springs near the Railroad east of Eighth Street drained into this system. In an EPA funded project in 1987, an 84" CSO Extension was constructed from the diversion structure west to a two cell CSO Basin. The new pipe was laid in the flow line of the existing drainage ditch effectively enclosing the ditch from the corporate limits to the CSO Basins. The effluent from the CSO Basins was originally to be drained through the existing ditch westward to a 72" culvert under State Road 61, then to Cypress Creek. This ditch has now been replaced with a pipe. The effluent from the City Lake, which contributed a large amount of "dry weather" inflow, has been removed, as has the "dry weather" flow from the spring near the railroad.

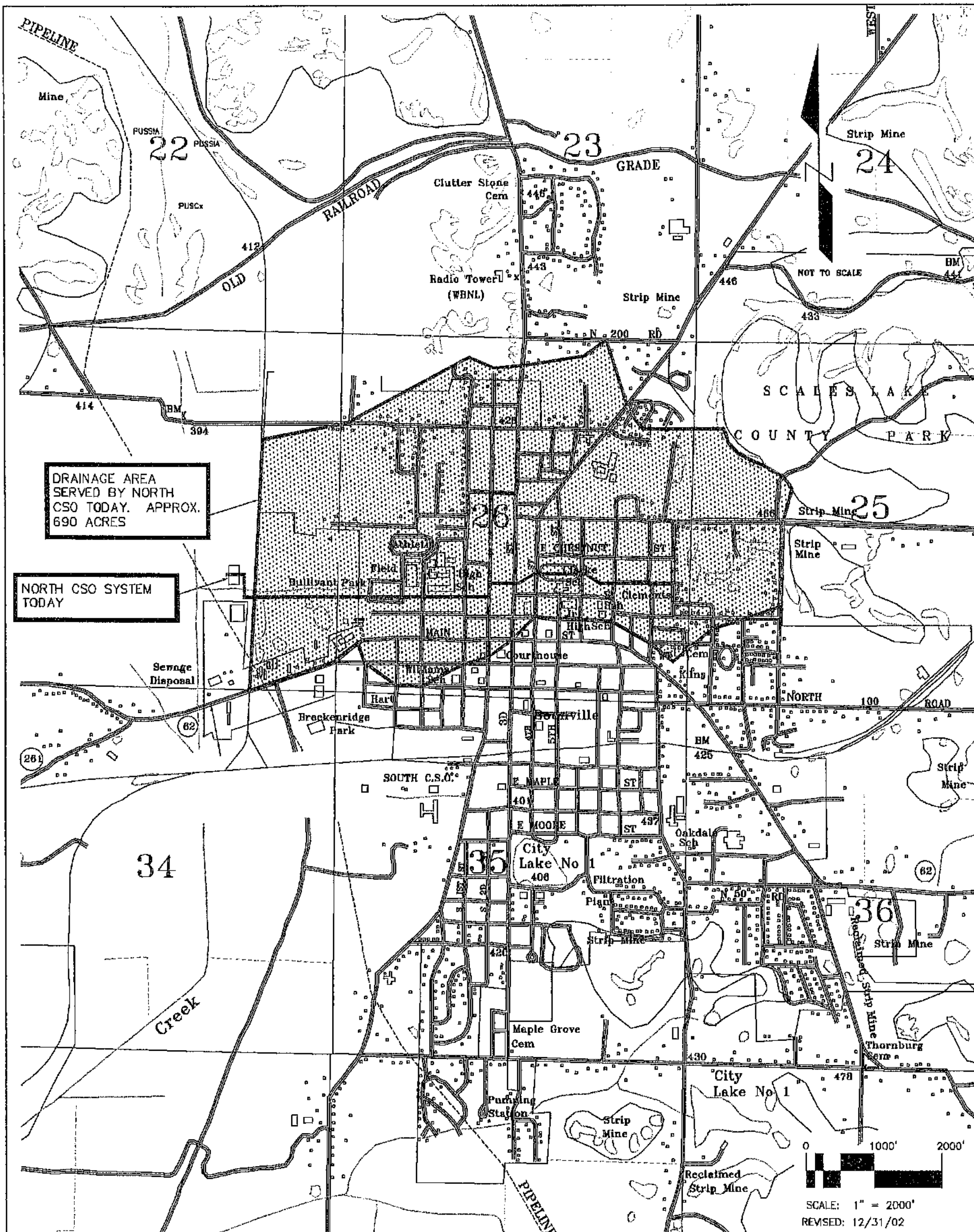
The CSO Basin was designed to capture 1.36 MG of storm water for return to the treatment plant after a storm event. Volume based upon wier elevation of 386.4. However, during operation, level increases as water slows over the effluent wier. Volume is calculated to be 5 MGD at 391 ft. This would include the "first flush" solids plus any additional solids which settle during a storm event. The high water level in the CSO Basins was set to match the elevation of the original diversion dam.

Improvements constructed in 1998 included electric operators for the South CSO sluice gates and a transfer pump which gives the operator the capacity to transfer basin contents, thus maximizing the available basin storage. Figure 3.B-2 is a map displaying the South CSO Basin.

In addition, the 1998 improvements included a check valve and pump station to prevent water from the North Drainage Basin from flowing into the South CSO Drainage Basin.

<u>Overall Sewer Map</u>

A system wide overall map displaying the 1998 improvements is shown on Figure 3.B-3.

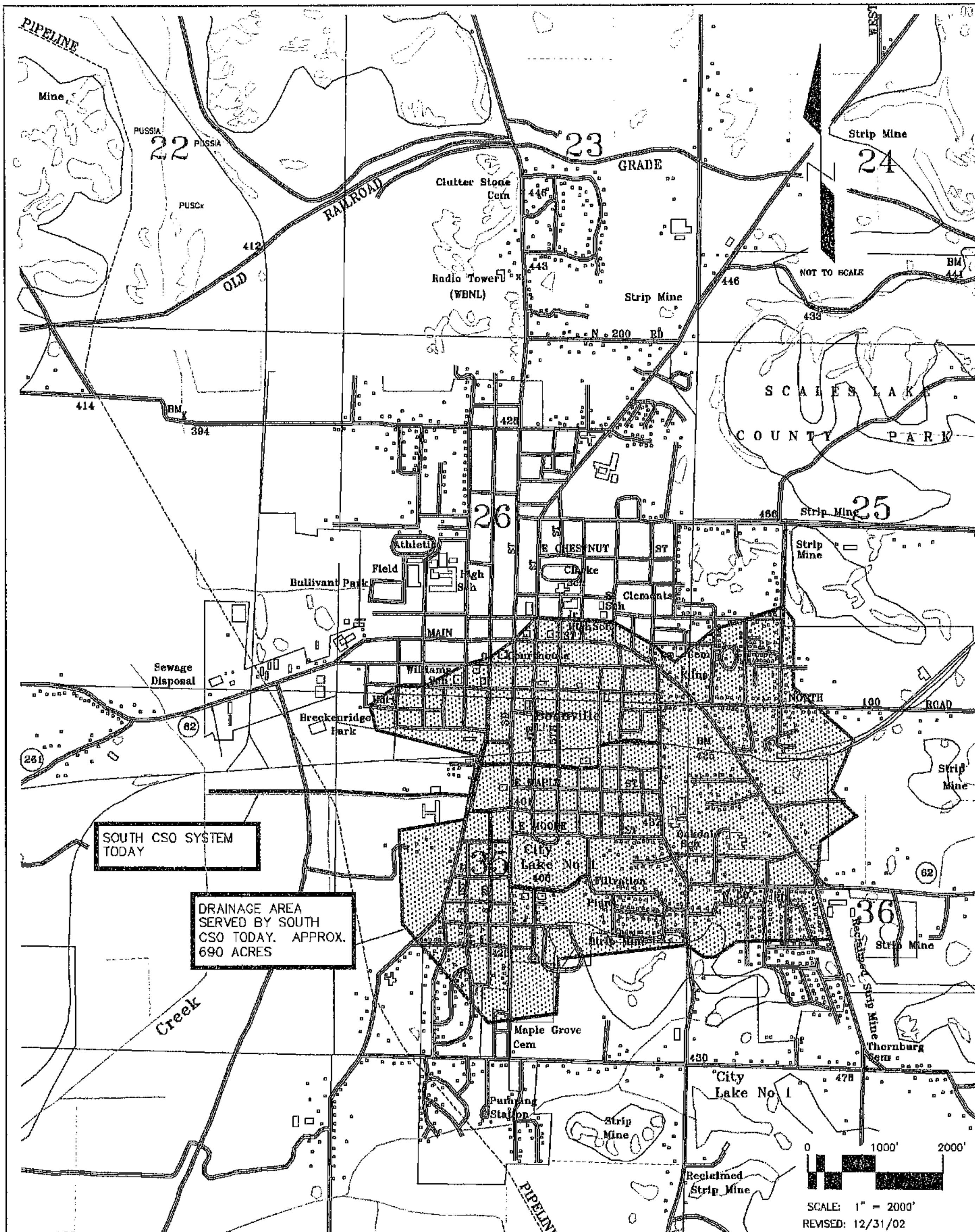


MIDWESTERN ENGINEERS, INC.
Civil Electrical Mechanical Consultants
LOOGOOTEE, INDIANA (812) 295-2800

FIGURE 3B-1
HYBRID TREATMENT PLANT

CITY OF BOONVILLE
WARRICK COUNTY, INDIANA

DATE JANUARY 1999
DESIGN D.L.D.
DRAWN S.L.H.
PROJECT NUMBER 97034-00



MIDWESTERN ENGINEERS, INC.

Civil Electrical Mechanical Consultants

LOOGOOTEE, INDIANA (812) 295-2800

FIGURE 3B-2

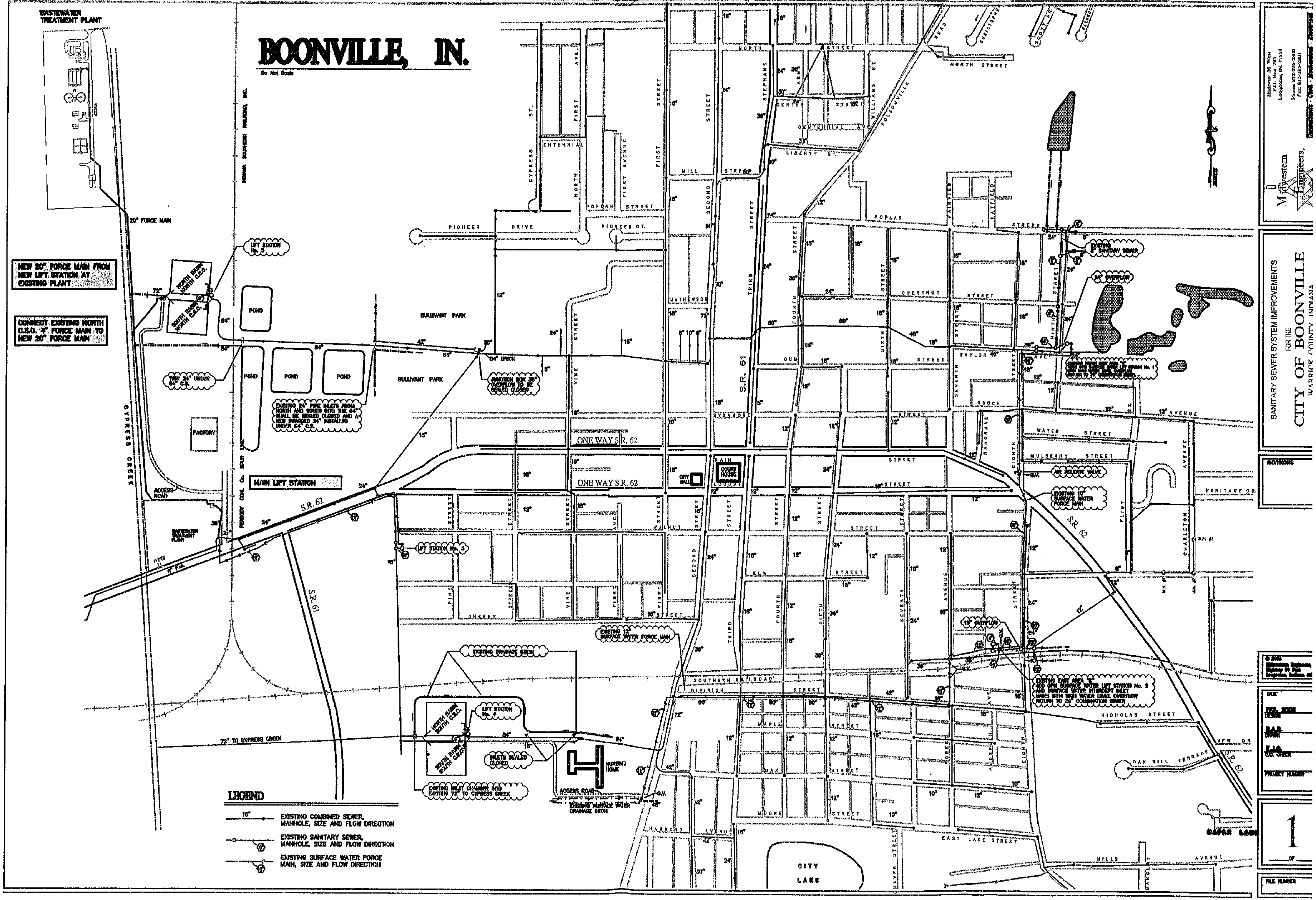
HYBRID TREATMENT PLANT

CITY OF BOONVILLE

WARRICK COUNTY, INDIANA

DATE	JANUARY 1999
DESIGN	D.L.D.
DRAWN	S.L.H.
PROJECT NUMBER	97034-00

2-28-06 Boonville 3-58


BOONVILLE, IN.
Do Not Scale
WASTEWATER TREATMENT PLANT
20" FORCE MAIN
NEW 20" FORCE MAIN FROM NEW LIFT STATION AT EXISTING PLANT
CONNECT EXISTING NORTH C.S.O. 4" FORCE MAIN TO NEW 20" FORCE MAIN
LIFT STATION No. 5
NORTH BASIN NORTH C.S.O.
SOUTH BASIN NORTH C.S.O.
POND
BULLIVANT PARK
FACTORY
MAIN LIFT STATION
ACCESS ROAD
WASTEWATER TREATMENT PLANT
CYPRESS CREEK
S.R. 62
S.R. 61
LIFT STATION No. 3
LIFT STATION No. 4
NORTH BASIN SOUTH C.S.O.
SOUTH BASIN SOUTH C.S.O.
72" TO CYPRESS CREEK
EXISTING DRAINAGE DITCH
INLETS SEALED CLOSED
EXISTING INLET CHAMBER INTO EXISTING 72" TO CYPRESS CREEK
NURSING HOME
ACCESS ROAD
EXISTING SURFACE WATER DRAINAGE DITCH
EXISTING 12" SURFACE WATER FORCE MAIN
ONE WAY S.R. 62
CITY HALL
COURT HOUSE
CITY LAKE
SOUTHERN RAILROAD
DIVISION STREET
NICHOLAS STREET
OAK HILL TERRACE
EAST LAKE STREET
MILLS AVENUE
HERITAGE DR.
12" AVENUE
WATER STREET
MULBERRY STREET
AIR RELEASE VALVE
EXISTING 10" SURFACE WATER FORCE MAIN
EXISTING EAST AREA "B" 400 GPM SURFACE WATER LIFT STATION No. 2 AND SURFACE WATER INTERCEPT INLET MAINS WITH HIGH WATER LEVEL OVERFLOW RETURN TO 36" COMBINATION SEWER
18" OVERFLOW
24" OVERFLOW
EXISTING 8" SANITARY SEWER
PIONEER DRIVE
POPLAR STREET
CHESTNUT STREET
TAYLOR
GUM
SYCAMORE
MAIN
LOCUST
WALNUT
ELM STREET
CHERRY
MAPLE STREET
OAK STREET
MOORE STREET
HAMMOND AVENUE
NORTH STREET
CENTER STREET
CENTENNIAL AVE.
LIBERTY ST.
MILL STREET
MATHEWSON
FOLSOMVILLE ROAD
LEGEND
EXISTING COMBINED SEWER, MANHOLE, SIZE AND FLOW DIRECTION
EXISTING SANITARY SEWER, MANHOLE, SIZE AND FLOW DIRECTION
EXISTING SURFACE WATER FORCE MAIN, SIZE AND FLOW DIRECTION
Midwestern Engineers, Inc.
Highway 50 West P.O. Box 295 Loogootee, IN 47553
SANITARY SEWER SYSTEM IMPROVEMENTS FOR THE CITY OF BOONVILLE WARRICK COUNTY, INDIANA
REVISIONS
DATE
PROJECT NUMBER
1
OF
FILE NUMBER

3-C CSO Monitoring

Prior to the 1998 project, records indicate there were 210 days of CSO discharge in 1996. After construction of the CSO improvements, the number of CSO days dropped markedly to 81 days for the 12 months ending September 2002. Now that the plant improvements have been built, total volume of overflows has dropped 75 to 85%. Obviously, the City of Boonville is making significant progress in managing its CSO's. After the 1998 improvements were made, the City completed its stream reach characterization and evaluation study and submitted it to IDEM.

During the Stream Reach Characterization and Evaluation Study the City of Boonville conducted a stream monitoring and sampling program. Samples were taken of Cypress Creek upstream of the City, at both CSO Basin overflows, and downstream below any further influence from city induced sidestreams.

A summation of the overall results in terms of impact and influence caused by overflow from the identified CSO structures upon the receiving stream would fall within the category of no noticeable impact. This is based on the analysis of water in the discharge stream itself as well as analysis of water within the receiving stream both above and below the confluence of the CSO discharge point. Each analyzed parameter will now be discussed individually in terms of CSO control efficiency and receiving stream impact.

During initial review of this LTCP, IDEM has expressed their opinion that the SRCER results are flawed. The City has embarked upon additional testing and monitoring as discussed in the City's Response Letter contained in Appendix "B". The following section presents the results of the 1997 SRCER.

<u>Biochemical Oxygen Demand (BOD)</u>

BOD concentrations in the CSO discharges at both the North and South structures show values of < 5.0 mg/L. This is well below the allowed limit as it pertains to the <u>Wastewater Treatment Plant.</u> The NPDES permit limit for BOD concentration is 20 and 25 mg/L for Summer and Winter months respectively. The CSOs do not impact the receiving stream in terms of BOD.

<u>Total Suspended Solids (TSS)</u>

The TSS values displayed at both the North and South CSO structures for the monitored overflow events were above the limits for the Wastewater Treatment Plant, but were well below the values of the receiving stream both above and below the CSO's discharge points. All values were above the TSS concentrations shown for dry weather analysis, but this would be expected since the stream would be quiescent during normal dry weather periods and turbulent during rainfall events. The contributing factor to the TSS quantity would be inorganic material such as sand and silt that is already present on the stream floor as well as that which is washed in from small tributaries along the main stream. Being inorganic in nature these solids would have no biological impact upon the receiving stream in terms of oxygen depletion. Also supporting this statement was the

analysis for Dissolved Oxygen (DO). There was no evidenced decline in the DO concentration during the monitored CSO events. The values of the CSO discharge compared to the stream values both above and below the points of discharge varied by only a few tenths of a milligram per liter. Based on the available data pertaining to TSS, there was no evidenced impact from the CSO discharge at both the North and South structures.

Ammonia, pH, E. Coli, Cyanide, and Lead

Ammonia, measured as Nitrogen, was well below the maximum limit as set for the discharge of the Wastewater Treatment Plant. Showing an average of 0.6 mg/L in all areas of the stream as well as the CSO discharge, this would be considered highly acceptable plant effluent in this respect. The NPDES Permit Limit for Ammonia-Nitrogen is 1.5 and 3.0 mg/L for Summer and Winter respectively.

pH and E. Coli

The CSO discharge stream displayed results for both parameters that were well within the limits set forth in the NPDES Permit for Treatment Plant Effluent. pH limits are to be between 6.0 and 9.0 standard units. Neither of the CSO discharge streams were below 7.0 or above 8.3. The samples taken upstream from the point of discharge at both the North and South CSO structures displayed a greater range of pH fluctuation than the discharge stream itself. Likewise the analysis for E. Coli was no greater than 4.5 colonies per 100 ml. The NPDES Limit for the same parameter pertaining to the discharge from the Wastewater Plant is 125 colonies per 100 ml. It is E. Coli results that IDEM has questioned.

Cyanide and Lead

Cyanide and Lead concentrations measured throughout the stream showed no influence from any contributing dischargers. The results were < 0.003 and no greater than 0.013 mg/L for cyanide and lead respectively. The Maximum Contaminant Levels set for drinking water are 0.2 and 0.015 mg/ L for the same pollutants.

In summary regarding the previously illustrated pollutant parameters; the discharge from the City's CSOs have little or no significant impact on the receiving stream.

Precipitation Amounts, CSO Events, Discharge Volume, and Duration

Section 3-A discussed rainfall events and overflow volumes. After the 1998 improvements, the total volume of overflows dropped to 497 MG in 2002. After construction of the new treatment plant, the total volume of overflows dropped to 136 MG. The improvements completed to date have effected a 73% decrease in the total system overflow volume.

Reviewing plant operation and the CSO records reveal a large number of small volume overflows (less than 0.5 MGD). Increasing the system return rate from 0.5 MGD at each CSO Basin to 1.0 MGD at each Basin would greatly increase flow treated at the plant and reduce both volume and frequency of CSO overflows.

3 - D Modeling of System

3-D-1 Design and Modeling Criteria

General

The Boonville System has been modeled a number of times, flow monitoring has also been completed a number of times.

In 1981 a 1.3" storm over 1 hr. 15 min. produced a peak rate of 65 MGD with a volume of 7.3 MGD at the North CSO (peak rate 37 MGD) and a volume of 4.8 MG at the South CSO (peak rate 28 MGD)

In 1986 the basins designs were established based upon modeling which produced the following storm volumes:

3 Month	30 Min	0.7" (1.4"/hr)	1.4 MG South 1.2 MG North
1 Year	30 Min.	0.95" (1.9"/hr)	2.0 MG South 1.7 MG North
5 Year	30 Min.	1.39" (2.78"/hr)	3.01 MG South 2.46 MG North

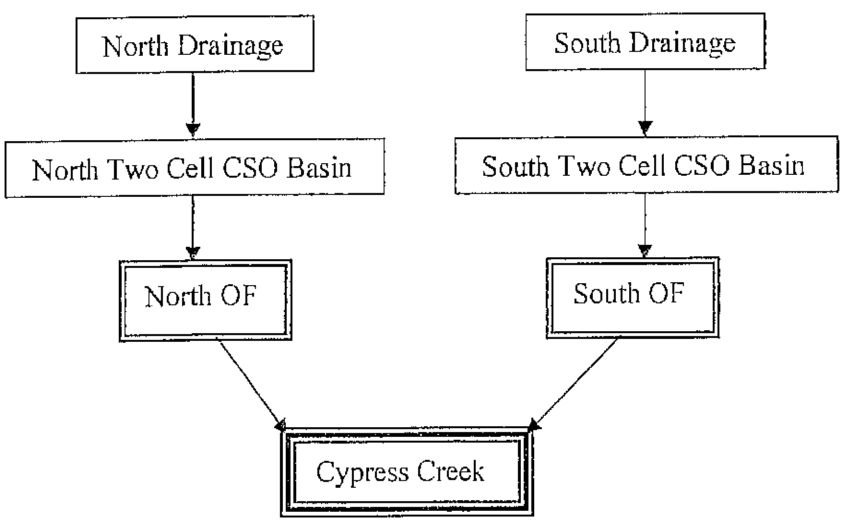
In 1993 at 1.5" storm was found to produce 34 MGD peak rate at the North CSO and 26 MGD rate at the South CSO.

In 1998 the Master Plan produced modeling results as follows:

5 Year	4 Hr.	2.9" (0.62"/hr)	134 MGD Peak North 115 MGD Peak South
1 Year	4 Hr.	2.8" (0.7"/hr)	151 MGD Peak North 140 MGD Peak South

LTCP Tabletop Rational Method

The City~~-of~~ Boonville's watershed is sub-divided into two (2) drainage areas. The total drainage area for the City including drainage that enters the City of Boonville corporation limits is approximately 1,350 acres. Please refer to the Watershed Maps 3.B-2 and 3.B-3. There are two (2) combined sewer overflows in the City of Boonville, which are the North and South overflows. The following illustration explains the drainage net for the City of Boonville watershed:



The conventional rational method (Q=CiA) was utilized to determine the peak flow produced by each drainage area for various rainfall amounts (0.5", 1", 1.5", & 2.0") and a 2 year return. Where Q is the peak flow rate in cubic feet per second, C is a unit-less coefficient which is dependent upon the ground cover and soil conditions within the drainage area, i is the rainfall intensity in inches per hour which is dependent on the time of concentration and is obtained from the Intensity duration frequency (IDF) curve which is dependent on the geographical location, and A is the drainage area in acres. Please refer to the spreadsheet located in the Appendix that was used to determine peak flows produced by the various drainage areas. For example, the peak flow rate for the north drainage area is 104.6 million gallons per day (MGD) and the total volume of runoff produced by a 2 year storm with a duration equal to the time of concentration of the drainage area would be 20.6 million gallons (MG).

IDEM DRAFT TREATMENT POLICY

Since this LTCP was initially prepared (2002) IDEM has proposed a Draft CSO Treatment Facility Design. CSO Treatment facilities would be designed to capture a 1 year 1 hour storm and to treat a 10 year 1 hour storm. For Boonville these storms would be 1.3 inches and 2.19 inches respectfully. Using the Rational Model for these storms produces the following peak rates and volumes.

1 Year 1 Hour (1.3 in/hr)

North CSO	Peak rate exceeds 84" capacity of 80 MGD Volume approximately 11.7 MG
South CSO	Peak rate exceeds 84" capacity of 80 MGD Volume approximately 10.7 MG

10 Year 1 Hour (2.19 in/hr)

North CSO	Peak rate exceeds 84" capacity of 100 MGD Volume approximately 19.8 MG
South CSO	Peak rate exceeds 84" capacity of 100 MGD Volume approximately 17.4 MG

Therefore, actual system flow will not exceed 80 MGD rate at IDEM design storms.

In Boonville the time of concentration will be greater than the duration of the IDEM Design Storms. To determine the impact of system attenuation and the predicted operation of the CSO basins hydrograph modeling was completed using Intelisolve software called "Hydrographs".

Using this software the Boonville system was divided into sub-drainage areas and rain flow was routed thru the North and South systems. The Design Storm Hydrograph was a constant rainfall over 60 minutes that produces a total of 1.3 inches for the 1 year storm and 2.19 inches for the 10 year storm.

North CSO Basin

A Hydrograph of the flow entering the North CSO was calculated by the model then applied to the North CSO basins.

For the 10 year storm the flow to the North basins will steadily increase over 1.5 hours to a peak of 110 cfs (71 MGD) then decrease to base line over next 5 hours. Discharge

from the North basins will be attenuated by storage and will increase over 1.75 hours to a peak of 66 cfs (42 MGD) then decrease.

For the 1 year storm, flow to the basin will increase to 10 cfs (6.5 MGD) then decrease. The basin will capture the design storm. (Model shows small overflow after 36 hours but this will be returned to plant when in operation.

The 2 Cell Basins were modeled as a Single Cell Basin of equal volume, with discharge regulated by a rectangular wier (crest elevation 387.4) followed by an 84 inch effluent pipe.

The North CSO basins comply with the draft IDEM design standard of capturing the 1 year storm.

North CSO Basin volume has been reported as 1.24 MGD. This is calculated with water at the outlet wier crest elevation of 387.4. In practice the outlet wier and effluent culvert combine to increase the pond depth (this varies with flow rate). The model shows that during a 10 year storm the North CSO basin surface will increase to 389.7 ft at a basin volume of over 2.0 MGD. Detention time at this volume and at the attenuated flow rate of 66 cfs will be over one hour. The North Basin which complies with the IDEM draft standard of 30 minutes at the 10 year storm. The following Figure displays the change in surface water elevation.

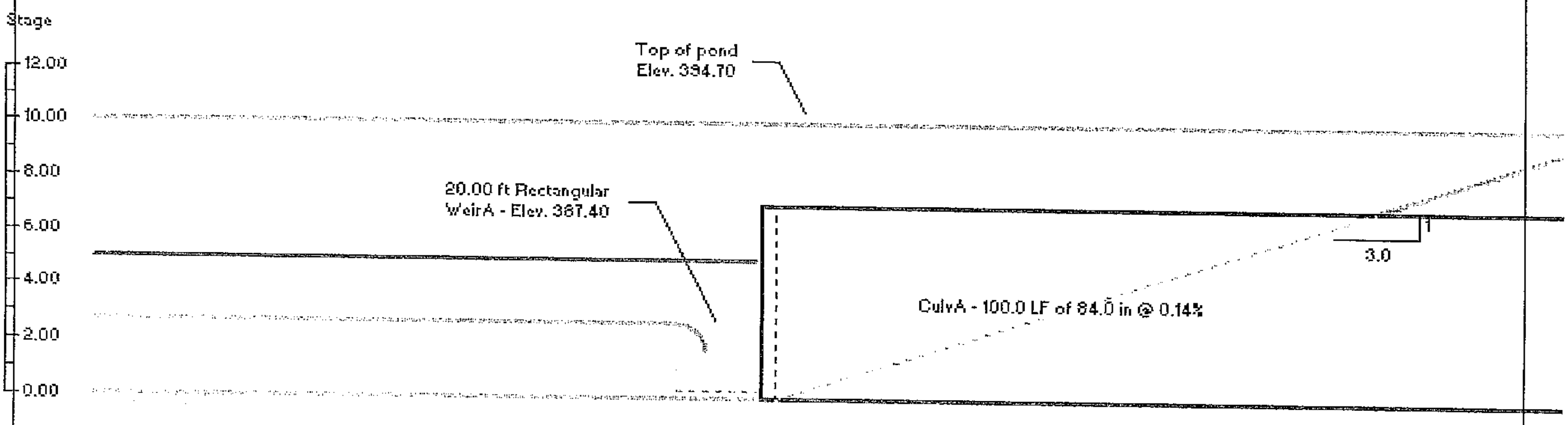
<u>South CSO</u>

The same procedure was followed to model the South CSO Basins. The model shows that the flow entering the South CSO Basins during a 10 year storm will increase to 82 cfs (53 MGD) during the first two hours, but will be attenuated by the basin to a peak discharge of 65 cfs (42 MGD). During a 1 year storm the peak flow of 6.5 cfs will be captured by the South Basins.

As in the North Basin the effluent pipe and wier will cause water level to rise above the effluent wier to a maximum elevation of 388.38 at a basin storage of 2.1 MG. Detention time at peak flow will be nearly 1 hour. The South Basin complies with the IDEM draft policy. The following Figure displays the change in surface elevation.

One evidence that the basins are providing primary treatment is that in last two years the City has removed over 600 dry tons of settled solids.

North CSO inlet basin

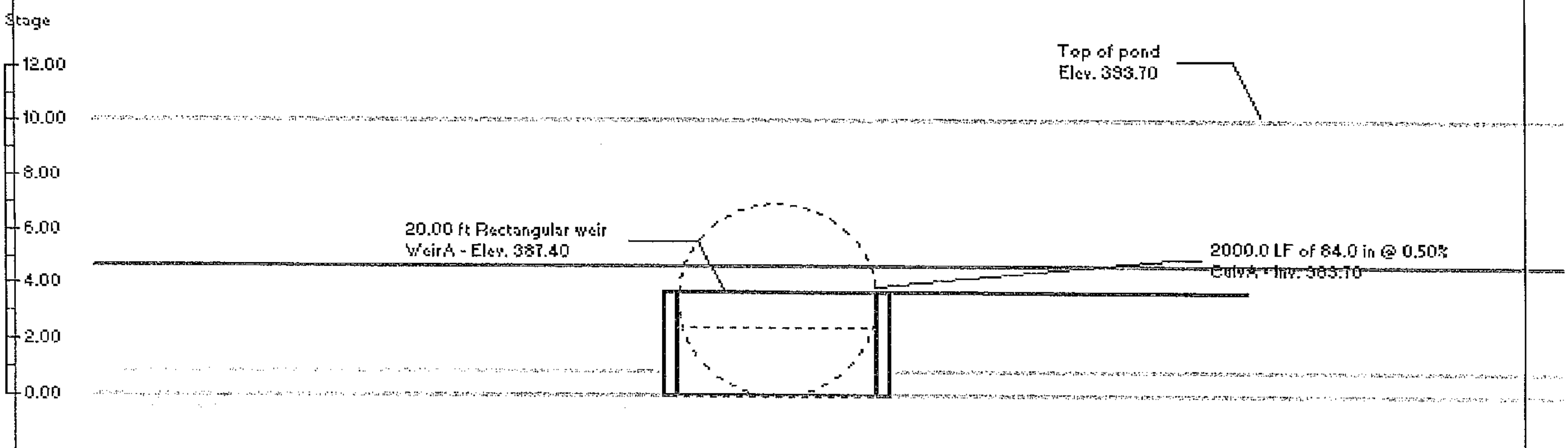


Section
NTS

Schematic only. Not for construction.

Hydraflow Hydrographs Pond Draw	Project: boonville north cso.gpw	Wednesday, Feb 22 2006, 2:49 PM

South CSO inlet basin



Front View

NTS - Looking Downstream

Schematic only. Not for construction.

Hydraflow Hydrographs Pond Draw	Project: boonville south cso.gpw	Wednesday, Feb 22 2006, 3:03 PM

3-D-2 Flow Quantity Verification

The calculated total flows were compared to actual flow measurement data received at the influent of the WWTP. The comparisons indicated that the modeled flow rates are a good representation of the actual flows measured for various rainfall events recorded by the City. For example, on March 2, 2002 a 0.92" storm event occurred which resulted in 23.69 MG of total flow from March 2 to March 8, 2002. If one considers only flow associated with rainfall, seven days of "dry weather" flow (7.7 MG) should be subtracted from this amount which indicates that 16.0 MG of flow was produced by the contributing north and south drainage areas. Based upon the rational method calculations, these drainage areas should contribute 17.0 MG of flow for a 1.0" storm event. This comparison indicates that the calculated flows are comparable to actual measurements taken.

3-D-3 "C" Coefficient Verification

The "C" coefficients used for the analysis were compared to actual rainfall events for the north and south drainage areas that flow to the WWTP. This was accomplished by calculating the weighted average of the "C" coefficients and comparing the weighted "C" to the actual recorded flows divided by the theoretical volume of rain over the above referenced drainage areas. The results indicate that the "C" coefficients used in the rational method are very similar to the actual calculated values based upon actual recorded flows.

<u>for the 0.92" rainfall event:</u>

Total recorded flow:	16 MG
Total drainage area:	690+660 = 1350 Acres
	1350 Acres x 43560 ft^2/Acre = 58,806,000 ft^2
	58,806,000 ft^2 x 12^2 in^2/ft^2 = 8,468,064,000 in^2
Total volume of rain:	8,468,064,000 in^2 x 0.92 in = 7,790,618,880 in^3
(theoretical)	7,790,618,880 in^3 / 12^3 in^3/ft^3 = 4,508,460 ft^3
	4,508,460 ft^3 x 7.48 gal/ft^3 = 33.72 MG
Actual "C" coefficient:	16 MG / 33.72 MG = **.474**

<u>weighted "C" coef.:</u>

[(690 x 0.486) + (660 x 0.452)] / 1350 = **.469**

3-D-4 Separation Alternatives

Alternate 1-A: This alternate consists of complete separation of the existing combined sewers in the North Drainage area.

Alternate 1-B: This alternate consists of complete separation of the existing combined sewers in the South Drainage area.

Alternate 1-C: This alternate consists of complete separation of the existing combined sewers in both the North and South Drainage areas.

Alternate 2-A: This alternate consists of screening and disinfection of the overflows resulting from a 2-year storm or less from the North CSO basin.

Alternate 2-B: This alternate consists of screening and disinfection of the overflows resulting from a 2-year storm or less from the South CSO basin.

Alternate 2-C: This alternate consists of screening and disinfection of the overflows resulting from a 2-year storm or less from both the North and South CSO basins.

Alternate 3-A: This alternate consists of screening of the overflows resulting from a 2-year storm or less from the North CSO basin.

Alternate 3-B: This alternate consists of screening of the overflows resulting from a 2-year storm or less from the South CSO basin.

Alternate 3-C: This alternate consists of screening of the overflows resulting from a 2-year storm or less from both the North and South CSO basins.

All alternatives will include the following basin improvements.

1. Tree removal
2. Repair of structures as required
3. Modification to CSO return pumping

North CSO

Replace 4" F.M. connection to new plant F.M. with an 10 inch force main. Connect transfer pump to Plant L.S. with new 6 inch force main allowing both pond return pump station and transfer pump L.S. to return pond contents to the plant F.M. this will increase return rate to 1.0 MGD.

South CSO

Install 10 inch force main from CSO Basin to Lift Station #3 (behind Long John Silvers). This will allow return to be pumped directly to plant. Connect pond transfer L.S. to new 10 inch F.M. This will increase return rate to 1.0 MGD.

Rational Method

Manning's 'n'

for a 2" storm

Sewer	Catchments Drained	Pipe Length	Pipe Slope	Total Area Drained	Increment Area	C	CA	Sum CA	Overland Flow Length	Overland Flow Slope	Kinematic "n"	Inlet Time	Channel Flow Time	Time of Conc	Time of Duration	Intensity	Design Q(cfs)	Effective Q(cfs)	Peak Rate MGD	Total MG	Dia Used	Flow Vel	Flow Time
	N Drainage				690.0	0.486	335.3							284.00		0.423	141.69		91.6	18.1			
	S Drainage				660.0	0.452	298.3							265.00		0.453	135.09		87.3	16.1			

R[illegible]l Method

Manning's 'n'

Sewer	Catchments Drained	Pipe Length	Pipe Slope	Total Area Drained	Increment Area	C	CA	Sum CA	Overland Flow Length	Overland Flow Slope	Kinematic "n"	Inlet Time	Channel Flow Time	Time of Conc	Time of Duration	Intensity	Design Q(cfs)	2 year storm Effective Q(cfs)	Peak Rate MGD	Total MG	Dia Used	Flow Vel	Flow Time
	N Drainage				690.0	0.486	335.3							284.00		0.483	161.91		104.6	20.6			
	S Drainage				660.0	0.452	298.3							265.00		0.500	149.07		96.3	17.7			

Rational Method

Manning's 'n'

10 Year 1 Hour

Sewer	Catchments Drained	Pipe Length	Pipe Slope	Total Area Drained	Increment Area	C	CA	Sum CA	Overland Flow Length	Overland Flow Slope	Kinematic "n"	Inlet Time	Channel Flow Time	Time of Conc	Time of Duration	Intensity	Design Q(cfs)	Effective Q(cfs)	Peak Rate MGD	Total MG	Dia Used	Flow Vel	Flow Time
	N Drainage				690.0	0.486	335.3							60		2.19	734		475	19.8			
	S Drainage				660.0	0.452	298.3							60		2.19	653		421	17.5			

However, max flow in 84" sewer entering each CSO basin is 122 CFS or 80 mGD.

Rational Method

	Manning's 'n'																	1 Year 1 Hour					
Sewer	Catchments Drained	Pipe Length	Pipe Slope	Total Area Drained	Increment Area	C	CA	Sum CA	Overland Flow Length	Overland Flow Slope	Kinematic "n"	Inlet Time	Channel Flow Time	Time of Conc	Time of Duration	Intensity	Design Q(cfs)	Effective Q(cfs)	Peak Rate MGD	Total MG	Dia Used	Flow Vel	Flow Time
	N Drainage				690.0	0.486	335.3							60		1.3	435		281	11.7			
	S Drainage				660.0	0.452	298.3							60		1.3	388		250	10.4			

However, max flow in 84" sewer entering each CSO basin is 122 CFS or 80 MGD.

Section 3 - Characterization, Monitoring, and Modeling

3-A Rainfall Records

Rainfall records kept at the City's WWTP were evaluated and found to be similar to those kept by the National Weather Service. The table 3.A-1 displays the monthly frequency of various sized rainfalls for 1998 thru 2000. From this data it was determined that to capture or treat all but an average of 4 overflows per year it would be necessary to treat all storms up to 2" in size. Rainfall intensity data is not available from the WWTP. At Boonville every drop of water discharged at each CSO point passes through the CSO basins receiving a minimum of primary treatment.

The WWTP maintains flow records for the plant as well as discharge records for both CSO basins. These records are shown in Table 3.A-2. It should be noted that rainfall data and overflow data are taken at different times of day, therefore, rainfall and overflow events listed do not always appear on the same day. For the 12 months ending September 2002, total rainfall was 56.47" well in excess of the average rainfall of 47". During this period, 666 MG were treated at the WWTP while 217 MG was discharged from the North CSO and 280 MG was discharged from the South CSO. Discharge from the North CSO occurred on 71 days and from the South CSO on 81 days. Many of these days would be considered single multiday events.

In October 2002 the City completed its new WWTP. This plant is designed to treat peak flows up to 9 MGD and average flows up to 5 MGD. This will greatly increase the amount of water treated at the plant and thus reduce the amount of CSO's discharged. Table 3.A-3 reflects the CSO monitoring data presented in Table 3.A-2 adjusted to reflect operation of the new plant. It is estimated that for the 12 months tabulated, the new plant would have greatly reduced overflows as follows.

	Actual CSO Records	Adjusted CSO Records
WWTP Flow Treated	666 MG	887 MG
North CSO Discharge	217 MG	124 MG
South CSO Discharge	280 MG	156 MG
North CSO # of Days	71	26
South CSO #of Days	81	24

Replaced 2-8-06

TABLE 3.A.-1
Rainfall frequency from Boonville MRO reports

	Days with Rain Greater than or Equal to 0.50"	Greater than or Equal to 1.00"	Greater than or Equal to 1.25"	Greater than or Equal to 1.5"	Greater than or Equal to 1.75"	Greater than 2"
January-98	1	0	0	0	0	0
February-98	1	0	0	0	0	0
March-98	2	0	0	0	0	0
April-98	4	2	2	2	1	1
May-98	3	1	0	0	0	0
June-98	9	4	2	2	1	1
July-98	3	3	0	0	0	0
August-98	3	1	1	1	0	0
September-98	0	0	0	0	0	0
October-98	3	1	1	0	0	0
November-98	2	1	1	0	0	0
December-98	4	2	2	2	1	1
98 TOTAL	35	15	9	7	3	3
	Days with Rain Greater than or Equal to 0.50"	Greater than or Equal to 1.00"	Greater than or Equal to 1.25"	Greater than or Equal to 1.5"	Greater than or Equal to 1.75"	Greater than 2"
January-99	4	3	1	1	1	1
February-99	0	0	0	0	0	0
March-99	5	2	1	0	0	0
April-99	4	2	2	0	0	0
May-99	3	1	1	1	0	0
June-99	6	2	0	0	0	0
July-99	1	0	0	0	0	0
August-99	1	0	0	0	0	0
September-99	0	0	0	0	0	0
October-99	1	1	1	1	1	1
November-99	0	0	0	0	0	0
December-99	4	0	0	0	0	0
99 TOTAL	29	11	6	3	2	2
	Days with Rain Greater than or Equal to 0.50"	Greater than or Equal to 1.00"	Greater than or Equal to 1.25"	Greater than or Equal to 1.5"	Greater than or Equal to 1.75"	Greater than 2"
January-00	2	1	1	1	1	1
February-00	5	3	2	2	1	1
March-00	2	1	1	0	0	0
April-00	1	1	0	0	0	0
May-00	1	0	0	0	0	0
June-00	5	2	2	1	1	0
July-00	2	2	2	2	1	1
August-00	5	3	1	1	1	0
September-00	4	1	1	0	0	0
October-00	0	0	0	0	0	0
November-00						
December-00						
00 TOTAL	27	14	10	7	5	3
TOTAL 1998 - 2000	**91**	**40**	**25**	**17**	**10**	**8**
Average/year	**30**	**13**	**8**	**6**	**3**	**3**

CSO FLOW DATA
OCTOBER, 2001 THRU SEPTEMBER, 2002

Date	Precipitation Inches	Influent Flow MGD	North CSO Overflow Volume MGD	South CSO Overflow Volume MGD
1-Oct-01		0.860		
2-Oct-01		0.830		
3-Oct-01		0.839		
4-Oct-01		0.863		
5-Oct-01	1.05	1.700		
6-Oct-01		1.566		
7-Oct-01		1.530		
8-Oct-01		1.413		
9-Oct-01		0.855		
10-Oct-01	0.07	1.450		
11-Oct-01	1.40	2.300	2.000	2.500
12-Oct-01	0.01	2.300		
13-Oct-01	1.13	2.250		
14-Oct-01	0.76	2.250	2.250	2.750
15-Oct-01	0.10	2.150		
16-Oct-01		2.050		
17-Oct-01		2.000		
18-Oct-01		1.650		
19-Oct-01		1.450		
20-Oct-01		1.150		
21-Oct-01		1.205		
22-Oct-01		1.496		
23-Oct-01	2.60	1.925	4.074	3.172
24-Oct-01	1.32	2.150	10.920	10.448
25-Oct-01		2.525	0.720	2.068
26-Oct-01		2.525		0.552
27-Oct-01		2.700		
28-Oct-01		2.450		
29-Oct-01		1.625		
30-Oct-01		1.400		
31-Oct-01		1.250		
Totals	8.440	52.707	19.964	21.490
Average		1.700	3.993	3.582
No. of Overflow days			5	6

Date	Precipitation Inches	Influent Flow MGD	North CSO Overflow Volume MGD	South CSO Overflow Volume MGD
1-Nov-01		1.100		
2-Nov-01	0.04	1.250		
3-Nov-01		1.366		
4-Nov-01		1.328		
5-Nov-01		1.299		
6-Nov-01		1.192		
7-Nov-01		1.214		
8-Nov-01		1.198		
9-Nov-01		1.254		
10-Nov-01		1.100		
11-Nov-01		1.124		
12-Nov-01		1.097		
13-Nov-01		1.244		
14-Nov-01		1.116		
15-Nov-01		1.126		
16-Nov-01		1.100		
17-Nov-01		1.113		
18-Nov-01		1.096		
19-Nov-01	0.29	1.650		
20-Nov-01		1.325		
21-Nov-01		1.103		
22-Nov-01		1.024		
23-Nov-01	0.01	1.043		
24-Nov-01	1.03	1.900	1.778	3.669
25-Nov-01		2.500		
26-Nov-01	0.37	2.700		
27-Nov-01	0.38	2.712	19.224	29.498
28-Nov-01	1.74	2.638		
29-Nov-01	1.3	2.400		
30-Nov-01	0.02	2.550		
Totals	5.18	44.862	21.002	33.167
Average		1.495	10.501	16.584
No. of Overflow Days			2	2

Date	Precipitation Inches	Influent Flow MGD	North CSO Overflow Volume MGD	South CSO Overflow Volume MGD
1-Dec-01		2.100		
2-Dec-01		2.000		
3-Dec-01		2.300		
4-Dec-01		2.350		
5-Dec-01		1.729		
6-Dec-01	0.7	0.556	5.316	4.682
7-Dec-01		2.400		
8-Dec-01	0.23	2.850		
9-Dec-01		2.400		
10-Dec-01		2.500		
11-Dec-01		2.300		
12-Dec-01	0.86	2.150	7.982	32.475
13-Dec-01	0.15	2.600		
14-Dec-01	0.37	2.653		
15-Dec-01		2.250		
16-Dec-01	2.37	2.400	12.122	
17-Dec-01	1.95	2.300		
18-Dec-01		2.500		
19-Dec-01	0.01	2.229		
20-Dec-01		2.159		
21-Dec-01		2.400		
22-Dec-01	0.46	2.400	0.950	3.711
23-Dec-01	0.08	2.325		
24-Dec-01		2.646		
25-Dec-01		2.402		
26-Dec-01		2.820		
27-Dec-01		2.400		
28-Dec-01		2.200		
29-Dec-01	0.01	1.822		
30-Dec-01		1.722		
31-Dec-01		1.710		
Totals	7.19	69.573	26.370	40.868
Average		2.244	6.593	13.623
No. of Overflow Days			4	3

Date	Precipitation Inches	Influent Flow MGD	North CSO Overflow Volume MGD	South CSO Overflow Volume MGD
1-Jan-02		1.597		1.500
2-Jan-02		1.594		1.010
3-Jan-02		1.570		0.500
4-Jan-02		1.447		
5-Jan-02		1.685		
6-Jan-02	0.26	1.176		
7-Jan-02		1.176		
8-Jan-02		1.610		
9-Jan-02		1.621		
10-Jan-02	0.01	1.573		
11-Jan-02		1.958		
12-Jan-02		1.697		
13-Jan-02		1.541		
14-Jan-02		1.445		
15-Jan-02		1.652		
16-Jan-02		1.395		
17-Jan-02		1.329		
18-Jan-02		1.677		
19-Jan-02	0.24	1.750		
20-Jan-02		1.535		
21-Jan-02		1.642		
22-Jan-02		1.615		
23-Jan-02	0.71	2.100	3.500	7.830
24-Jan-02	0.71	1.838	3.000	1.193
25-Jan-02		2.397	2.000	0.486
26-Jan-02		2.141	1.000	0.160
27-Jan-02		2.214		
28-Jan-02		2.310		
29-Jan-02		2.449		
30-Jan-02		1.865	4.500	4.750
31-Jan-02		2.315	3.500	3.250
Totals	1.93	53.914	17.500	20.679
Average		1.739	2.917	2.298
No. of Overflow Days			6	9

Date	Precipitation Inches	Influent Flow MGD	North CSO Overflow Volume MGD	South CSO Overflow Volume MGD
1-Feb-02		2.900	1.500	1.500
2-Feb-02		2.514		1.010
3-Feb-02		2.459		0.500
4-Feb-02		2.594		
5-Feb-02		2.500		
6-Feb-02	0.03	2.678		
7-Feb-02		2.573		
8-Feb-02		2.310		
9-Feb-02		2.350		
10-Feb-02	0.01	2.450		
11-Feb-02		2.050		
12-Feb-02		2.050		
13-Feb-02		1.972		
14-Feb-02		1.480		
15-Feb-02		2.788		
16-Feb-02		1.559		
17-Feb-02		1.417		
18-Feb-02		1.634		
19-Feb-02	0.31	2.000		
20-Feb-02	0.14	2.250		
21-Feb-02		1.900		
22-Feb-02		1.593		
23-Feb-02		1.450		
24-Feb-02		1.400		
25-Feb-02	0.44	1.595		
26-Feb-02	0.01	2.450		
27-Feb-02		2.687		
28-Feb-02		1.800		
Totals	0.94	59.403	1.5	3.01
Average		2.122	1.500	1.003
No. of Overflow Days			1	3

Date	Precipitation Inches	Influent Flow MGD	North CSO Overflow Volume MGD	South CSO Overflow Volume MGD
1-Mar-02		1.460		
2-Mar-02	0.92	2.250	2.297	3.702
3-Mar-02		2.250	0.252	1.795
4-Mar-02		2.425		0.472
5-Mar-02		2.450		
6-Mar-02		2.200		
7-Mar-02		2.000		
8-Mar-02		1.600		
9-Mar-02	0.86	2.240	0.829	3.375
10-Mar-02		2.200	0.006	1.605
11-Mar-02	0.11	2.200	0.005	0.952
12-Mar-02	0.01	2.500		0.580
13-Mar-02		2.415		0.002
14-Mar-02		2.250		
15-Mar-02	0.75	2.150	0.326	1.085
16-Mar-02		2.500	2.421	3.958
17-Mar-02	0.03	2.452	0.164	1.680
18-Mar-02	0.08	2.625	0.035	0.851
19-Mar-02	1.69	2.593	4.403	5.467
20-Mar-02	0.51	2.750	9.102	10.377
21-Mar-02		2.800	1.053	2.482
22-Mar-02		2.650	0.014	1.378
23-Mar-02		2.143		0.315
24-Mar-02	0.01	2.260		
25-Mar-02	1.31	2.900	3.046	5.164
26-Mar-02	0.31	2.725	9.791	8.664
27-Mar-02		2.500	1.004	2.437
28-Mar-02	0.01	3.000	0.011	0.857
29-Mar-02	0.36	2.800	0.089	2.175
30-Mar-02		2.600		1.072
31-Mar-02		2.725		0.178
Totals	6.96	74.613	34.848	60.623
Average		2.407	1.936	2.526
No. of Overflow Days			18	24

Date	Precipitation Inches	Influent Flow MGD	North CSO Overflow Volume MGD	South CSO Overflow Volume MGD
1-Apr-02		2.525		
2-Apr-02	0.16	2.500		
3-Apr-02		2.300		
4-Apr-02		2.300		
5-Apr-02		2.100		
6-Apr-02		2.300		
7-Apr-02		2.000		
8-Apr-02	0.36	2.000		
9-Apr-02	0.01	2.100		
10-Apr-02		2.300		
11-Apr-02		2.000		
12-Apr-02	0.50	2.754	1.014	6.412
13-Apr-02	1.32	2.100	10.223	10.076
14-Apr-02	2.11	2.100	6.500	5.000
15-Apr-02	0.03	2.325	3.200	2.500
16-Apr-02		2.700	1.000	0.750
17-Apr-02		2.500		
18-Apr-02		2.400		
19-Apr-02	0.78	2.561		
20-Apr-02	0.16	2.357	6.500	6.000
21-Apr-02	1.39	2.350	5.000	4.250
22-Apr-02		2.300	4.000	4.000
23-Apr-02		2.250	2.000	2.000
24-Apr-02	1.47	2.725	6.188	5.756
25-Apr-02		2.725	0.975	0.609
26-Apr-02		2.700	0.072	
27-Apr-02	1.19	2.334	5.944	8.967
28-Apr-02		2.506	1.435	2.740
29-Apr-02		2.500	0.039	
30-Apr-02		2.400	0.008	
Totals	9.48	71.012	54.098	59.06
Average		2.367	3.381	4.543
No. of Overflow Days			16	13

Date	Precipitation Inches	Influent Flow MGD	North CSO Overflow Volume MGD	South CSO Overflow Volume MGD
1-May-02	0.01	2.686		
2-May-02	0.43	2.600		
3-May-02		2.700		
4-May-02		2.715		
5-May-02	0.03	2.458		
6-May-02	0.51	2.799	4.616	4.500
7-May-02	0.64	2.659	0.318	1.000
8-May-02	0.16	2.701	4.386	5.000
9-May-02	0.04	2.570	0.581	1.000
10-May-02		2.447	0.100	0.500
11-May-02		2.000		0.050
12-May-02	1.27	2.600	1.227	1.750
13-May-02	0.32	2.647	6.222	7.000
14-May-02		2.947	1.186	1.250
15-May-02		2.814	0.059	0.750
16-May-02	0.16	2.924		
17-May-02	0.37	3.192		
18-May-02		2.869		2.000
19-May-02		2.741		1.000
20-May-02		2.592		
21-May-02		2.750		
22-May-02		2.425		
23-May-02		1.900		
24-May-02		1.525		
25-May-02		0.934		
26-May-02		1.400		
27-May-02		1.400		
28-May-02		1.658		
29-May-02	1.50	2.250	1.218	0.012
30-May-02		2.348	0.050	
31-May-02		2.320		
Totals	5.44	74.571	19.963	25.812
Average		2.406	1.815	1.986
No. of Overflow Days			11	13

Date	Precipitation Inches	Influent Flow MGD	North CSO Overflow Volume MGD	South CSO Overflow Volume MGD
1-Jun-02		1.801		
2-Jun-02		1.448		
3-Jun-02		1.363		
4-Jun-02	0.24	1.594		
5-Jun-02	0.11	2.000		
6-Jun-02	0.54	2.513	1.250	1.000
7-Jun-02		2.260		
8-Jun-02		2.057		
9-Jun-02		1.738		
10-Jun-02		1.342		
11-Jun-02	0.04	1.278		
12-Jun-02	0.15	1.390		
13-Jun-02	0.30	2.183		
14-Jun-02		1.810		
15-Jun-02		1.699		
16-Jun-02	0.02	1.315		
17-Jun-02	0.06	1.222		
18-Jun-02		1.129		
19-Jun-02		1.122		
20-Jun-02		1.120		
21-Jun-02		1.138		
22-Jun-02		1.131		
23-Jun-02		1.139		
24-Jun-02	0.01	1.175		
25-Jun-02	0.02	1.092		
26-Jun-02		0.858		
27-Jun-02	0.65	0.900		
28-Jun-02	0.45	1.800	1.500	1.250
29-Jun-02		1.751		
30-Jun-02		1.238		
Totals	2.59	44.606	2.750	2.250
Average		1.487	1.375	1.125
No. of Overflow Days			2	2

Date	Precipitation Inches	Influent Flow MGD	North CSO Overflow Volume MGD	South CSO Overflow Volume MGD
1-Jul-02		1.531		
2-Jul-02		1.507		
3-Jul-02		1.641		
4-Jul-02		1.242		
5-Jul-02		1.164		
6-Jul-02	0.04	1.184		
7-Jul-02		1.056		
8-Jul-02		1.052		
9-Jul-02	0.22	1.286		
10-Jul-02	0.10	1.215		
11-Jul-02		1.071		
12-Jul-02		1.015		
13-Jul-02		1.295		
14-Jul-02		1.038		
15-Jul-02		1.511		
16-Jul-02		1.063		
17-Jul-02	0.28	1.503		
18-Jul-02	1.42	1.762		
19-Jul-02		1.863		
20-Jul-02		1.862		
21-Jul-02		1.306		
22-Jul-02		1.123		
23-Jul-02	0.06	1.771		
24-Jul-02		1.239		
25-Jul-02		1.189		
26-Jul-02		1.209		
27-Jul-02		1.151		
28-Jul-02		1.093		
29-Jul-02		1.369		
30-Jul-02	0.33	1.164		
31-Jul-02		1.542		
Totals	2.45	41.017	0.000	0.000
Average		1.323		
No. of Overflow Days			0	0

Date	Precipitation Inches	Influent Flow MGD	North CSO Overflow Volume MGD	South CSO Overflow Volume MGD
1-Aug-02		1.226		
2-Aug-02		1.090		
3-Aug-02		1.111		
4-Aug-02		1.094		
5-Aug-02		1.094		
6-Aug-02		1.089		
7-Aug-02		0.552		
8-Aug-02		0.861		
9-Aug-02		1.114		
10-Aug-02		1.131		
11-Aug-02		1.105		
12-Aug-02		1.116		
13-Aug-02	0.35	1.500		
14-Aug-02	0.22	2.200		
15-Aug-02		1.591		
16-Aug-02		1.386		
17-Aug-02		1.159		
18-Aug-02		1.187		
19-Aug-02	0.10	1.200		
20-Aug-02		1.193		
21-Aug-02		1.158		
22-Aug-02		1.195		
23-Aug-02		1.400		
24-Aug-02	0.12	1.383		
25-Aug-02		1.139		
26-Aug-02		1.155		
27-Aug-02		1.132		
28-Aug-02		1.118		
29-Aug-02		1.110		
30-Aug-02		1.140		
31-Aug-02		1.241		
Totals	0.79	37.170	0.000	0.000
Average		1.199		
No. of Overflow Days			0	0

Date	Precipitation Inches	Influent Flow MGD	North CSO Overflow Volume MGD	South CSO Overflow Volume MGD
1-Sep-02		1.097		
2-Sep-02		1.122		
3-Sep-02		1.155		
4-Sep-02		1.166		
5-Sep-02		1.145		
6-Sep-02		1.143		
7-Sep-02		1.474		
8-Sep-02		1.100		
9-Sep-02		1.211		
10-Sep-02		1.150		
11-Sep-02		1.169		
12-Sep-02		1.124		
13-Sep-02		1.144		
14-Sep-02		1.310		
15-Sep-02	0.24	1.550		
16-Sep-02		1.100		
17-Sep-02	0.18	1.100		
18-Sep-02	0.65	1.376		
19-Sep-02	1.10	2.500	10.000	8.000
20-Sep-02	1.04	2.524	5.000	3.000
21-Sep-02	0.01	2.524	1.500	0.750
22-Sep-02		1.800	0.500	0.250
23-Sep-02		1.729		
24-Sep-02		1.093		
25-Sep-02		1.069		
26-Sep-02	1.82	2.000	2.000	1.500
27-Sep-02		1.700	0.500	0.300
28-Sep-02	0.04	1.700		
29-Sep-02		1.300		
30-Sep-02		1.300		
Totals	5.08	42.875	19.500	13.800
Average		1.429	3.250	2.300
No. of Overflow Days			6	6
YEAR TOTAL	56.47	666.323	217.495	280.759
YEAR TOTAL NO. OF OVERFLOW DAYS			71	81

TABLE 3.A.-3

ADJUSTED
CSO FLOW DATA
OCTOBER, 2001 THRU SEPTEMBER, 2002
ADJUSTED TO REFLECT ADDITION OF NEW PLANT

Date	Precipitation Inches	Influent Flow MGD	North CSO Overflow Volume MGD	South CSO Overflow Volume MGD
1-Oct-01		0.860		
2-Oct-01		0.830		
3-Oct-01		0.839		
4-Oct-01		0.863		
5-Oct-01	1.05	1.700		
6-Oct-01		1.566		
7-Oct-01		1.530		
8-Oct-01		1.413		
9-Oct-01		0.855		
10-Oct-01	0.07	1.450		
11-Oct-01	1.40	6.800		
12-Oct-01	0.01	2.300		
13-Oct-01	1.13	2.250		
14-Oct-01	0.76	7.250		
15-Oct-01	0.10	2.150		
16-Oct-01		2.050		
17-Oct-01		2.000		
18-Oct-01		1.650		
19-Oct-01		1.450		
20-Oct-01		1.150		
21-Oct-01		1.205		
22-Oct-01		1.496		
23-Oct-01	2.60	9.000	1.780	1.390
24-Oct-01	1.32	9.000	7.260	7.250
25-Oct-01		5.313		
26-Oct-01		3.080		
27-Oct-01		2.700		
28-Oct-01		2.450		
29-Oct-01		1.625		
30-Oct-01		1.400		
31-Oct-01		1.250		
Totals	8.440	79.475	9.040	8.640
Average		2.564	4.520	4.320
No. of Overflow days			2	2

Date	Precipitation Inches	Influent Flow MGD	North CSO Overflow Volume MGD	South CSO Overflow Volume MGD
1-Nov-01		1.100		
2-Nov-01	0.04	1.250		
3-Nov-01		1.366		
4-Nov-01		1.328		
5-Nov-01		1.299		
6-Nov-01		1.192		
7-Nov-01		1.214		
8-Nov-01		1.198		
9-Nov-01		1.254		
10-Nov-01		1.100		
11-Nov-01		1.124		
12-Nov-01		1.097		
13-Nov-01		1.244		
14-Nov-01		1.116		
15-Nov-01		1.126		
16-Nov-01		1.100		
17-Nov-01		1.113		
18-Nov-01		1.096		
19-Nov-01	0.29	1.650		
20-Nov-01		1.325		
21-Nov-01		1.103		
22-Nov-01		1.024		
23-Nov-01	0.01	1.043		
24-Nov-01	1.03	7.350		
25-Nov-01		2.500		
26-Nov-01	0.37	2.700		
27-Nov-01	0.38	9.000	16.740	25.690
28-Nov-01	1.74	2.638		
29-Nov-01	1.3	2.400		
30-Nov-01	0.02	2.550		
Totals	5.18	56.600	16.74	25.69
Average		1.887	16.74	25.690
No. of Overflow Days			1	1

Date	Precipitation Inches	Influent Flow MGD	North CSO Overflow Volume MGD	South CSO Overflow Volume MGD
1-Dec-01		2.100		
2-Dec-01		2.000		
3-Dec-01		2.300		
4-Dec-01		2.350		
5-Dec-01		1.729		
6-Dec-01	0.7	9.000	0.826	0.728
7-Dec-01		2.400		
8-Dec-01	0.23	2.850		
9-Dec-01		2.400		
10-Dec-01		2.500		
11-Dec-01		2.300		
12-Dec-01	0.86	9.000	6.630	26.970
13-Dec-01	0.15	2.600		
14-Dec-01	0.37	2.653		
15-Dec-01		2.250		
16-Dec-01	2.37	9.000	5.520	
17-Dec-01	1.95	2.300		
18-Dec-01		2.500		
19-Dec-01	0.01	2.229		
20-Dec-01		2.159		
21-Dec-01		2.400		
22-Dec-01	0.46	7.060		
23-Dec-01	0.08	2.325		
24-Dec-01		2.646		
25-Dec-01		2.402		
26-Dec-01		2.820		
27-Dec-01		2.400		
28-Dec-01		2.200		
29-Dec-01	0.01	1.822		
30-Dec-01		1.722		
31-Dec-01		1.710		
Totals	7.19	96.127	12.976	27.698
Average		3.101	6.593	13.623
No. of Overflow Days			3	2

Date	Precipitation Inches	Influent Flow MGD	North CSO Overflow Volume MGD	South CSO Overflow Volume MGD
1-Jan-02		1.597		1.500
2-Jan-02		1.594		1.010
3-Jan-02		1.570		0.500
4-Jan-02		1.447		
5-Jan-02		1.685		
6-Jan-02	0.26	1.176		
7-Jan-02		1.176		
8-Jan-02		1.610		
9-Jan-02		1.621		
10-Jan-02	0.01	1.573		
11-Jan-02		1.958		
12-Jan-02		1.697		
13-Jan-02		1.541		
14-Jan-02		1.445		
15-Jan-02		1.652		
16-Jan-02		1.395		
17-Jan-02		1.329		
18-Jan-02		1.677		
19-Jan-02	0.24	1.750		
20-Jan-02		1.535		
21-Jan-02		1.642		
22-Jan-02		1.615		
23-Jan-02	0.71	9.000	1.370	3.060
24-Jan-02	0.71	6.030		
25-Jan-02		4.880		
26-Jan-02		3.300		
27-Jan-02		2.214		
28-Jan-02		2.310		
29-Jan-02		2.449		
30-Jan-02		9.000	1.030	1.090
31-Jan-02		9.000	0.065	
Totals	1.93	82.468	2.465	7.160
Average		2.660	0.822	1.432
No. of Overflow Days			3	2

Date	Precipitation Inches	Influent Flow MGD	North CSO Overflow Volume MGD	South CSO Overflow Volume MGD
1-Feb-02		5.900		
2-Feb-02		3.524		
3-Feb-02		2.959		
4-Feb-02		2.594		
5-Feb-02		2.500		
6-Feb-02	0.03	2.678		
7-Feb-02		2.573		
8-Feb-02		2.310		
9-Feb-02		2.350		
10-Feb-02	0.01	2.450		
11-Feb-02		2.050		
12-Feb-02		2.050		
13-Feb-02		1.972		
14-Feb-02		1.480		
15-Feb-02		2.788		
16-Feb-02		1.559		
17-Feb-02		1.417		
18-Feb-02		1.634		
19-Feb-02	0.31	2.000		
20-Feb-02	0.14	2.250		
21-Feb-02		1.900		
22-Feb-02		1.593		
23-Feb-02		1.450		
24-Feb-02		1.400		
25-Feb-02	0.44	1.595		
26-Feb-02	0.01	2.450		
27-Feb-02		2.687		
28-Feb-02		1.800		
Totals	0.94	63.913	0	0
Average		2.283	0	0
No. of Overflow Days			0	0

Date	Precipitation Inches	Influent Flow MGD	North CSO Overflow Volume MGD	South CSO Overflow Volume MGD
1-Mar-02		1.460		
2-Mar-02	0.92	8.249		
3-Mar-02		4.295		
4-Mar-02		2.897		
5-Mar-02		2.450		
6-Mar-02		2.200		
7-Mar-02		2.000		
8-Mar-02		1.600		
9-Mar-02	0.86	6.440		
10-Mar-02		3.811		
11-Mar-02	0.11	3.157		
12-Mar-02	0.01	3.080		
13-Mar-02		2.417		
14-Mar-02		2.250		
15-Mar-02	0.75	3.561		
16-Mar-02		8.879		
17-Mar-02	0.03	4.296		
18-Mar-02	0.08	3.511		
19-Mar-02	1.69	9.000	1.540	1.900
20-Mar-02	0.51	9.000	6.180	7.050
21-Mar-02		6.330		
22-Mar-02		4.040		
23-Mar-02		2.458		
24-Mar-02	0.01	2.260		
25-Mar-02	1.31	9.000	0.780	1.330
26-Mar-02	0.31	9.000	6.460	5.720
27-Mar-02		5.940		
28-Mar-02	0.01	3.868		
29-Mar-02	0.36	5.060		
30-Mar-02		3.672		
31-Mar-02		2.903		
Totals	6.96	139.084	14.960	16.000
Average		4.487	3.740	4.000
No. of Overflow Days			4	4

Date	Precipitation Inches	Influent Flow MGD	North CSO Overflow Volume MGD	South CSO Overflow Volume MGD
1-Apr-02		2.525		
2-Apr-02	0.16	2.500		
3-Apr-02		2.300		
4-Apr-02		2.300		
5-Apr-02		2.100		
6-Apr-02		2.300		
7-Apr-02		2.000		
8-Apr-02	0.36	2.000		
9-Apr-02	0.01	2.100		
10-Apr-02		2.300		
11-Apr-02		2.000		
12-Apr-02	0.50	9.000	0.160	1.018
13-Apr-02	1.32	9.000	6.740	6.650
14-Apr-02	2.11	9.000	2.600	2.000
15-Apr-02	0.03	8.025		
16-Apr-02		4.430		
17-Apr-02		2.500		
18-Apr-02		2.400		
19-Apr-02	0.78	2.561		
20-Apr-02	0.16	9.000	3.040	2.820
21-Apr-02	1.39	9.000	1.400	1.200
22-Apr-02		9.000	0.650	0.650
23-Apr-02		6.250		
24-Apr-02	1.47	9.000	2.940	2.670
25-Apr-02		4.309		
26-Apr-02		2.772		
27-Apr-02	1.19	9.000	3.290	4.960
28-Apr-02		6.680		
29-Apr-02		2.539		
30-Apr-02		2.408		
Totals	9.48	71.012	54.098	59.06
Average		2.367	3.381	4.543
No. of Overflow Days			8	8

Date	Precipitation Inches	Influent Flow MGD	North CSO Overflow Volume MGD	South CSO Overflow Volume MGD
1-May-02	0.01	2.686		
2-May-02	0.43	2.600		
3-May-02		2.700		
4-May-02		2.715		
5-May-02	0.03	2.458		
6-May-02	0.51	9.000	1.480	1.440
7-May-02	0.64	3.977		
8-May-02	0.16	9.000	1.440	1.640
9-May-02	0.04	4.151		
10-May-02		3.047		
11-May-02		2.050		
12-May-02	1.27	5.577		
13-May-02	0.32	9.000	3.230	3.640
14-May-02		5.383		
15-May-02		3.623		
16-May-02	0.16	2.924		
17-May-02	0.37	3.192		
18-May-02		4.869		
19-May-02		3.741		
20-May-02		2.592		
21-May-02		2.750		
22-May-02		2.425		
23-May-02		1.900		
24-May-02		1.525		
25-May-02		0.934		
26-May-02		1.400		
27-May-02		1.400		
28-May-02		1.658		
29-May-02	1.50	3.480		
30-May-02		2.398		
31-May-02		2.320		
Totals	5.44	107.475	6.15	6.72
Average		3.467	2.050	2.240
No. of Overflow Days			3	3

Date	Precipitation Inches	Influent Flow MGD	North CSO Overflow Volume MGD	South CSO Overflow Volume MGD
1-Jun-02		1.801		
2-Jun-02		1.448		
3-Jun-02		1.363		
4-Jun-02	0.24	1.594		
5-Jun-02	0.11	2.000		
6-Jun-02	0.54	4.763		
7-Jun-02		2.260		
8-Jun-02		2.057		
9-Jun-02		1.738		
10-Jun-02		1.342		
11-Jun-02	0.04	1.278		
12-Jun-02	0.15	1.390		
13-Jun-02	0.30	2.183		
14-Jun-02		1.810		
15-Jun-02		1.699		
16-Jun-02	0.02	1.315		
17-Jun-02	0.06	1.222		
18-Jun-02		1.129		
19-Jun-02		1.122		
20-Jun-02		1.120		
21-Jun-02		1.138		
22-Jun-02		1.131		
23-Jun-02		1.139		
24-Jun-02	0.01	1.175		
25-Jun-02	0.02	1.092		
26-Jun-02		0.858		
27-Jun-02	0.65	0.900		
28-Jun-02	0.45	4.550		
29-Jun-02		1.751		
30-Jun-02		1.238		
Totals	2.59	49.606	0.000	0.000
Average		1.654	0	0
No. of Overflow Days			0	0

Date	Precipitation Inches	Influent Flow MGD	North CSO Overflow Volume MGD	South CSO Overflow Volume MGD
1-Jul-02		1.531		
2-Jul-02		1.507		
3-Jul-02		1.641		
4-Jul-02		1.242		
5-Jul-02		1.164		
6-Jul-02	0.04	1.184		
7-Jul-02		1.056		
8-Jul-02		1.052		
9-Jul-02	0.22	1.286		
10-Jul-02	0.10	1.215		
11-Jul-02		1.071		
12-Jul-02		1.015		
13-Jul-02		1.295		
14-Jul-02		1.038		
15-Jul-02		1.511		
16-Jul-02		1.063		
17-Jul-02	0.28	1.503		
18-Jul-02	1.42	1.762		
19-Jul-02		1.863		
20-Jul-02		1.862		
21-Jul-02		1.306		
22-Jul-02		1.123		
23-Jul-02	0.06	1.771		
24-Jul-02		1.239		
25-Jul-02		1.189		
26-Jul-02		1.209		
27-Jul-02		1.151		
28-Jul-02		1.093		
29-Jul-02		1.369		
30-Jul-02	0.33	1.164		
31-Jul-02		1.542		
Totals	2.45	41.017	0.000	0.000
Average		1.323		
No. of Overflow Days			0	0

Date	Precipitation Inches	Influent Flow MGD	North CSO Overflow Volume MGD	South CSO Overflow Volume MGD
1-Aug-02		1.226		
2-Aug-02		1.090		
3-Aug-02		1.111		
4-Aug-02		1.094		
5-Aug-02		1.094		
6-Aug-02		1.089		
7-Aug-02		0.552		
8-Aug-02		0.861		
9-Aug-02		1.114		
10-Aug-02		1.131		
11-Aug-02		1.105		
12-Aug-02		1.116		
13-Aug-02	0.35	1.500		
14-Aug-02	0.22	2.200		
15-Aug-02		1.591		
16-Aug-02		1.386		
17-Aug-02		1.159		
18-Aug-02		1.187		
19-Aug-02	0.10	1.200		
20-Aug-02		1.193		
21-Aug-02		1.158		
22-Aug-02		1.195		
23-Aug-02		1.400		
24-Aug-02	0.12	1.383		
25-Aug-02		1.139		
26-Aug-02		1.155		
27-Aug-02		1.132		
28-Aug-02		1.118		
29-Aug-02		1.110		
30-Aug-02		1.140		
31-Aug-02		1.241		
Totals	0.79	37.170	0.000	0.000
Average		1.199		
No. of Overflow Days			0	0

Date	Precipitation Inches	Influent Flow MGD	North CSO Overflow Volume MGD	South CSO Overflow Volume MGD
1-Sep-02		1.097		
2-Sep-02		1.122		
3-Sep-02		1.155		
4-Sep-02		1.166		
5-Sep-02		1.145		
6-Sep-02		1.143		
7-Sep-02		1.474		
8-Sep-02		1.100		
9-Sep-02		1.211		
10-Sep-02		1.150		
11-Sep-02		1.169		
12-Sep-02		1.124		
13-Sep-02		1.144		
14-Sep-02		1.310		
15-Sep-02	0.24	1.550		
16-Sep-02		1.100		
17-Sep-02	0.18	1.100		
18-Sep-02	0.65	1.376		
19-Sep-02	1.10	9.000	6.390	5.110
20-Sep-02	1.04	9.000	0.950	0.570
21-Sep-02	0.01	4.770		
22-Sep-02		2.550		
23-Sep-02		1.729		
24-Sep-02		1.093		
25-Sep-02		1.069		
26-Sep-02	1.82	5.500		
27-Sep-02		2.500		
28-Sep-02	0.04	1.700		
29-Sep-02		1.300		
30-Sep-02		1.300		
Totals	5.08	63.147	7.340	5.680
Average		2.105	3.670	2.840
No. of Overflow Days			2	2
ANNUAL TOTAL	56.47	887.094	123.769	156.648
ANNUAL TOTAL NO. OF OVERFLOW DAYS			26	24

The size of storm leading to an overflow varies depending upon season and time after a previous rain. It is difficult to determine a trigger level rain. It is better to consider specific months.

In October 2001, overflows occurred for three (3) storms greater than 1.5 inches. After adjusting for the new plant, overflows would be expected for one storm greater than 2 inches. In March 2002, three (3) storms greater than 0.75 inches and two (2) rainy periods of over 1.5 inches caused overflows. After adjusting for the new plant, only the two rainy periods of over 1.5 inches would cause overflows.

One aspect of the new plant which has not been accounted for, is that before completion of the new plant, the contents of the CSO basins could not be returned for several days after a rain. With the larger capacity, these basins can be returned sooner, and thus will more often be empty, increasing the amount of first flush volume captured each year.

3-B Combined Sewer System Characterization

The City of Boonville's system includes two major combined sewer drainage basins and a smaller portion of newer separate sewers. The combined sewer systems are identified as the North CSO and the South CSO.

North CSO Basin

The northern portion of Boonville is served by a combined sewer system which terminates with an 84" brick sewer lying on the southside of Bullivant Park. Prior to 1987, a combined sewer diversion structure was located near the City's West Corporation Limits at the ball fields. A diversion dam in the invert of the 84" sewer diverted "dry weather" flows into a 15" sewer for conveyance to the WWTP. Flows which exceeded the capacity of the WWTP would discharge over the diversion into a drainage ditch approximately one half mile to Cypress Creek. In addition to the CSO discharge, this ditch drained surface water from over 200 acres of low lying ground west of Boonville, north of State Road 62 and east of the Railroad. Prior to 1987, approximately 440 acres were drained by the CSO Basin, including the 24" outlet pipe from a strip pit on Ninth Street which drains approximately 78 acres, and two inlets on Poplar which drain 15 acres each, and one inlet on Eighth Street which drains 13 acres. In the EPA funded project in 1987, an 84" CSO Extension was constructed from the diversion structure west to a two cell CSO Basin. The new pipe was laid in the flow line of the existing drainage ditch effectively enclosing the ditch from the corporate limits to the railroad tracks. In 1998 the City diverted the Dry Weather Flow from the strip pit to a location outside the CSO system.

The CSO Basin was designed to capture 1.12 MG of storm water for return to the treatment plant after a storm event. This would include the "first flush" solids plus any additional solids which settle during a storm event. The high water level in the CSO Basins was set to match the elevation of the original diversion dam.

Improvements constructed in 1998 included electric operators for the North CSO sluice gates and a transfer pump which gives the operator the capacity to transfer basin contents, thus maximizing the available basin storage. Figure 3.B-1 is a map displaying the North CSO Basin.

South CSO Basin

The southern portion of Boonville is served by a combined sewer system which terminates with an 84" brick sewer lying on the west side of Yankeetown Road south of the Railroad. Prior to 1987, a combined sewer diversion structure was located just west of Yankeetown Road. A diversion dam in the invert of the 84" sewer diverted "dry weather" flows into a 15" sewer for conveyance to the WWTP. Storm flows which exceeded the capacity of the WWTP would discharge over the diversion into a drainage ditch which flowed one mile to Cypress Creek. In addition to the CSO discharge, this ditch drained surface water from several acres of low lying ground west of Yankeetown

Road. Ground water springs near the Railroad east of Eighth Street drained into this system. In an EPA funded project in 1987, an 84" CSO Extension was constructed from the diversion structure west to a two cell CSO Basin. The new pipe was laid in the flow line of the existing drainage ditch effectively enclosing the ditch from the corporate limits to the CSO Basins. The effluent from the CSO Basins was originally to be drained through the existing ditch westward to a 72" culvert under State Road 61, then to Cypress Creek. This ditch has now been replaced with a pipe. The effluent from the City Lake, which contributed a large amount of "dry weather" inflow, has been removed, as has the "dry weather" flow from the spring near the railroad.

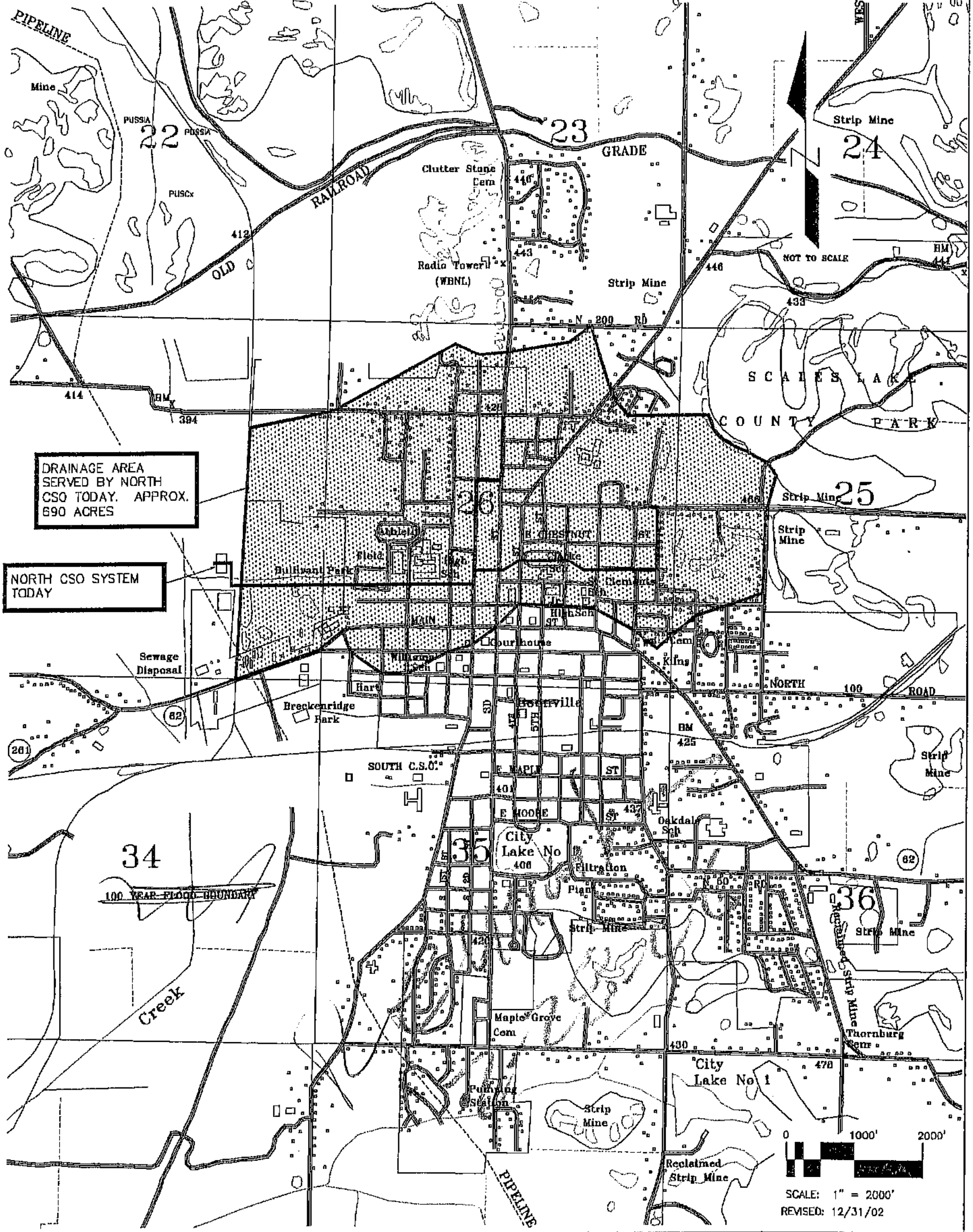
The CSO Basin was designed to capture 1.36 MG of storm water for return to the treatment plant after a storm event. This would include the "first flush" solids plus any additional solids which settle during a storm event. The high water level in the CSO Basins was set to match the elevation of the original diversion dam.

Improvements constructed in 1998 included electric operators for the South CSO sluice gates and a transfer pump which gives the operator the capacity to transfer basin contents, thus maximizing the available basin storage. Figure 3.B-2 is a map displaying the South CSO Basin.

In addition, the 1998 improvements included a check valve and pump station to prevent water from the North Drainage Basin from flowing into the South CSO Drainage Basin.

Overall Sewer Map

A system wide overall map displaying the 1998 improvements is shown on Figure 3.B-3.



MIDWESTERN ENGINEERS, INC.

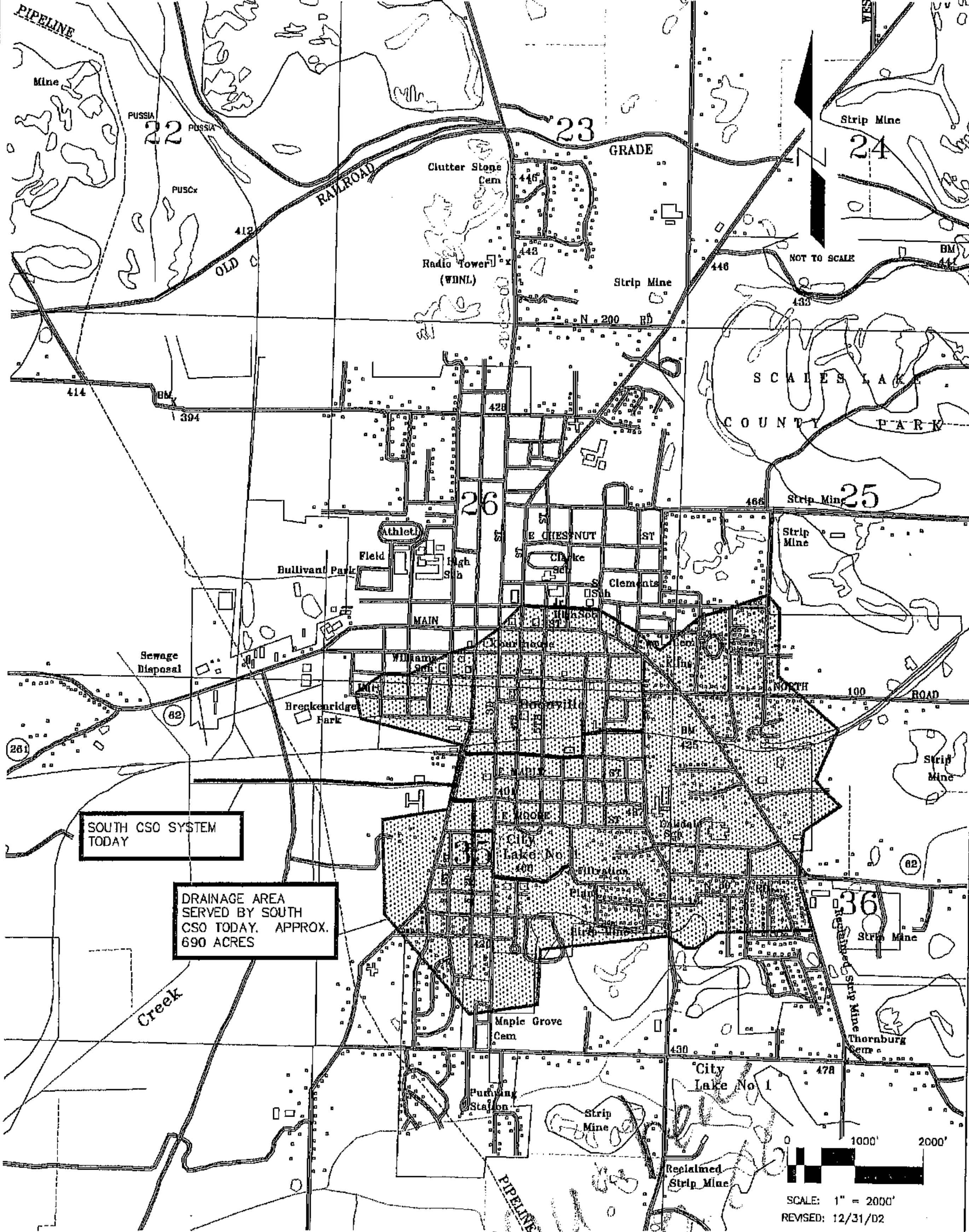
Civil Electrical Mechanical Consultants

LOOGOOTEE, INDIANA (812) 295-2800

FIGURE 3B-1
HYBRID TREATMENT PLANT

CITY OF BOONVILLE
WARRICK COUNTY, INDIANA

DATE
JANUARY 1999
DESIGN
D.L.O.
DRAWN
S.L.H.
PROJECT NUMBER
97034-00



MIDWESTERN ENGINEERS, INC.

Civil Electrical Mechanical Consultants

LOOGOOTEE, INDIANA (812) 295-2800

FIGURE 3B-2
HYBRID TREATMENT PLANT

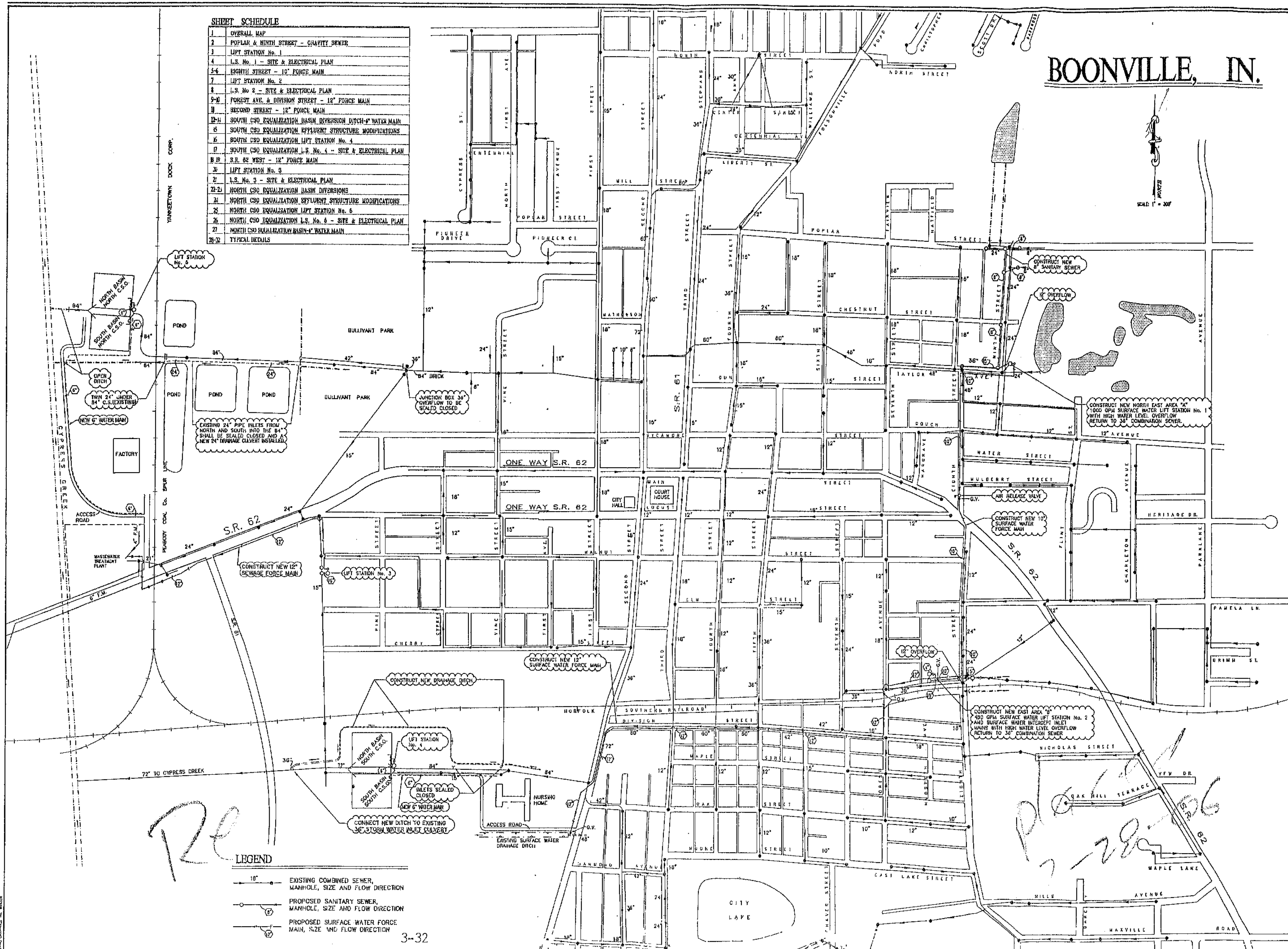
CITY OF BOONVILLE
WARRICK COUNTY, INDIANA

DATE	JANUARY 1999
DESIGN	D.L.D.
DRAWN	S.L.H.
PROJECT NUMBER	97034-00

BOONVILLE, IN.

SHEET SCHEDULE

1	OVERALL MAP
2	POPLAR & NINTH STREET - GRAVITY SEWER
3	LIFT STATION No. 1
4	L.S. No. 1 - SITE & ELECTRICAL PLAN
5-6	EIGHTH STREET - 10" FORCE MAIN
7	LIFT STATION No. 2
8	L.S. No 2 - SITE & ELECTRICAL PLAN
9-10	FOREST AVE. & DIVISION STREET - 12" FORCE MAIN
11	SECOND STREET - 12" FORCE MAIN
12-14	SOUTH CSO EQUALIZATION BASIN DIVERSION DITCH-6" WATER MAIN
15	SOUTH CSO EQUALIZATION EFFLUENT STRUCTURE MODIFICATIONS
16	SOUTH CSO EQUALIZATION LIFT STATION No. 4
17	SOUTH CSO EQUALIZATION L.S. No. 4 - SITE & ELECTRICAL PLAN
18 19	S.R. 62 WEST - 12" FORCE MAIN
20	LIFT STATION No. 3
21	L.S. No. 3 - SITE & ELECTRICAL PLAN
22-23	NORTH CSO EQUALIZATION BASIN DIVERSIONS
24	NORTH CSO EQUALIZATION EFFLUENT STRUCTURE MODIFICATIONS
25	NORTH CSO EQUALIZATION LIFT STATION No. 6
26	NORTH CSO EQUALIZATION L.S. No. 6 - SITE & ELECTRICAL PLAN
27	NORTH CSO EQUALIZATION BASIN-6" WATER MAIN
28-32	TYPICAL DETAILS



LEGEND

18" EXISTING COMBINED SEWER, MANHOLE, SIZE AND FLOW DIRECTION

PROPOSED SANITARY SEWER, MANHOLE, SIZE AND FLOW DIRECTION

PROPOSED SURFACE WATER FORCE MAIN, SIZE AND FLOW DIRECTION

3-32

MIDWESTERN ENGINEERS, INC.
Civil Electrical Mechanical Consultants
LOOGOOTEE, INDIANA
(812) 295-2800

COMBINED STORM / SANITARY SEWER
DRY WEATHER INFLOW REMOVAL IMPROVEMENTS
FOR THE CITY OF
BOONVILLE
WARRICK COUNTY, INDIANA

REVISIONS

RECORD DRAWING

JG	L.S.
DRAWN	DESIGN
JG	12-97
INSPECTOR	DATE

DAVID L. DANI REGISTERED No. 18887 STATE OF INDIANA PROFESSIONAL ENGINEER

DATE
FEB., 1998
DESIGN
D.L.D.-L.S.
DRAWN
L.S.-K.S.
Q.C. CHECK
G.A.M.
PROJECT NUMBER
97034

1
OF

FILE NUMBER

3-C *CSO Monitoring*

Prior to the 1998 project, records indicate there were 210 days of CSO discharge in 1996. After construction of the CSO improvements, the number of CSO days dropped markedly to 81 days for the 12 months ending September 2002. Now that the plant improvements have been built, it is estimated that the number of overflow days will drop to 26. Obviously, the City of Boonville is making significant progress in managing its CSO's. After the 1998 improvements were made, the City completed its stream reach characterization and evaluation study.

During the Stream Reach Characterization and Evaluation Study the City of Boonville conducted a stream monitoring and sampling program. Samples were taken of Cypress Creek upstream of the City, at both CSO Basin overflows, and downstream below any further influence from city induced sidestreams.

A summation of the overall results in terms of impact and influence caused by overflow from the identified CSO structures upon the receiving stream would fall within the category of no noticeable impact. This is based on the analysis of water in the discharge stream itself as well as analysis of water within the receiving stream both above and below the confluence of the CSO discharge point. Each analyzed parameter will now be discussed individually in terms of CSO control efficiency and receiving stream impact.

Biochemical Oxygen Demand (BOD)

BOD concentrations in the CSO discharges at both the North and South structures show values of < 5.0 mg/L. This is well below the allowed limit as it pertains to the Wastewater Treatment Plant. The NPDES permit limit for BOD concentration is 20 and 25 mg/L for Summer and Winter months respectively. The CSOs do not impact the receiving stream in terms of BOD.

Total Suspended Solids (TSS)

The TSS values displayed at both the North and South CSO structures for the monitored overflow events were above the limits for the Wastewater Treatment Plant, but were well below the values of the receiving stream both above and below the CSO's discharge points. All values were above the TSS concentrations shown for dry weather analysis, but this would be expected since the stream would be quiescent during normal dry weather periods and turbulent during rainfall events. The contributing factor to the TSS quantity would be inorganic material such as sand and silt that is already present on the stream floor as well as that which is washed in from small tributaries along the main stream. Being inorganic in nature these solids would have no biological impact upon the receiving stream in terms of oxygen depletion. Also supporting this statement was the analysis for Dissolved Oxygen (DO). There was no evidenced decline in the DO concentration during the monitored CSO events. The values of the CSO discharge compared to the stream values both above and below the points of discharge varied by only a few tenths of a milligram per liter. Based on the available data pertaining to TSS, there was no evidenced impact from the CSO discharge at both the North and South structures.

Ammonia, pH, E.Coli, Cyanide, and Lead

Ammonia, measured as Nitrogen, was well below the maximum limit as set for the discharge of the Wastewater Treatment Plant. Showing an average of 0.6 mg/L in all areas of the stream as well as the CSO discharge, this would be considered highly acceptable plant effluent in this respect. The NPDES Permit Limit for Ammonia-Nitrogen is 1.5 and 3.0 mg/L for Summer and Winter respectively.

pH and E.Coli

The CSO discharge stream displayed results for both parameters that were well within the limits set forth in the NPDES Permit for Treatment Plant Effluent. pH limits are to be between 6.0 and 9.0 standard units. Neither of the CSO discharge streams were below 7.0 or above 8.3. The samples taken upstream from the point of discharge at both the North and South CSO structures displayed a greater range of pH fluctuation than the discharge stream itself. Likewise the analysis for E. Coli was no greater than 4.5 colonies per 100 ml. The NPDES Limit for the same parameter pertaining to the discharge from the Wastewater Plant is 125 colonies per 100 ml.

Cyanide and Lead

Cyanide and Lead concentrations measured throughout the stream showed no influence from any contributing dischargers. The results were < 0.003 and no greater than 0.013 mg/L for cyanide and lead respectively. The Maximum_Contaminant Levels set for drinking water are 0.2 and 0.015 mg/ L for the same pollutants.

In summary regarding the previously illustrated pollutant parameters; the discharge from the City's CSOs have little or no significant impact on the receiving stream.

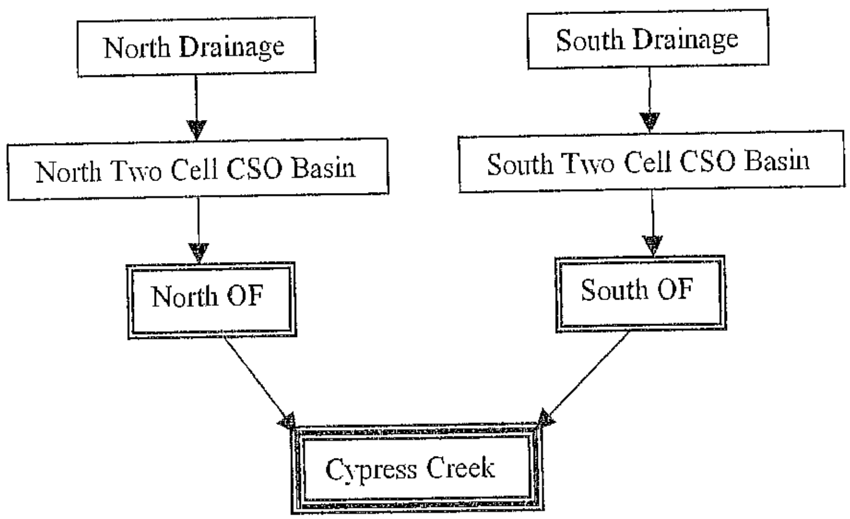
Precipitation Amounts,CSO Events, Discharge Volume, and Duration

The recorded precipitation amounts used for the report spanned a 3 year period. Data was recorded from February ,1998 through November,2000. The average recorded rainfall amount causing a discharge at the North and South CSO Basins was 1.78" and 1.94" respectively. During that time there were 50 recorded and reported CSO events from the North Structure and 48 events from the South Structure. This yields a calculated average of 16.7 and 16.0 events per year respectively. Both CSO structures averaged 18+ million gallons per event. The maximum discharge for one event was 210 million gallons at the North Structure and 302 million gallons at the South Structure. These volumes were recorded in February 1998. Since that time the CSO structures have undergone improvement in both structural improvements and operating procedures. In the last two and one-half years the maximum discharge has significantly decreased due to the above mentioned construction rehabilitation and improved management strategies. Couple this with the no significant impact found pertaining to the discharged pollutants in a CSO discharge stream and there is an indication of a properly managed CSO program.

3 - D Modeling of System

3–D–1 Design and Modeling Criteria

The City of Boonville's watershed is sub-divided into two (2) drainage areas. The total drainage area for the City including drainage that enters the City of Boonville corporation limits is approximately 1,350 acres. Please refer to the Watershed Maps 3.B-2 and 3.B-3. There are two (2) combined sewer overflows in the City of Boonville, which are the North and South overflows. The following illustration explains the drainage net for the City of Boonville watershed:



The conventional rational method (Q=CiA) was utilized to determine the peak flow produced by each drainage area for various rainfall amounts (0.5", 1", 1.5", & 2.0") and a 2 year return. Where Q is the peak flow rate in cubic feet per second, C is a unit-less coefficient which is dependent upon the ground cover and soil conditions within the drainage area, i is the rainfall intensity in inches per hour which is dependent on the time of concentration and is obtained from the Intensity duration frequency (IDF) curve which is dependent on the geographical location, and A is the drainage area in acres. Please refer to the spreadsheet located in the Appendix that was used to determine peak flows produced by the various drainage areas. For example, the peak flow rate for the north drainage area is 104.6 million gallons per day (MGD) and the total volume of runoff produced by a 2 year storm with a duration equal to the time of concentration of the drainage area would be 20.6 million gallons (MG).

3–D–2 Flow Quantity Verification

The calculated total flows were compared to actual flow measurement data received at the influent of the WWTP. The comparisons indicated that the modeled flow rates are a good representation of the actual flows measured for various rainfall events recorded by the City. For example, on March 2, 2002 a 0.92" storm event occurred which resulted in 23.69 MG of total flow from March 2 to March 8, 2002. If one considers only flow associated with rainfall, seven days of "dry weather" flow (7.7 MG) should be subtracted from this amount which indicates that 16.0 MG of flow was produced by the contributing north and south drainage areas. Based upon the rational method calculations, these drainage areas should contribute 17.0 MG of flow for a 1.0" storm event. This comparison indicates that the calculated flows are comparable to actual measurements taken.

3–D–3 "C" Coefficient Verification

The "C" coefficients used for the analysis were compared to actual rainfall events for the north and south drainage areas that flow to the WWTP. This was accomplished by calculating the weighted average of the "C" coefficients and comparing the weighted "C" to the actual recorded flows divided by the theoretical volume of rain over the above referenced drainage areas. The results indicate that the "C" coefficients used in the rational method are very similar to the actual calculated values based upon actual recorded flows.

for the 0.92" rainfall event:

Total recorded flow:	16 MG
Total drainage area:	690+660 = 1350 Acres
	1350 Acres x 43560 ft^2/Acre = 58,806,000 ft^2
	58,806,000 ft^2 x 12^2 in^2/ft^2 = 8,468,064,000 in^2
Total volume of rain:	8,468,064,000 in^2 x 0.92 in = 7,790,618,880 in^3
(theoretical)	7,790,618,880 in^3 / 12^3 in^3/ft^3 = 4,508,460 ft^3
	4,508,460 ft^3 x 7.48 gal/ft^3 = 33.72 MG
Actual "C" coefficient:	16 MG / 33.72 MG = **.474**

weighted "C" coef.:

[(690 x 0.486) + (660 x 0.452)] / 1350 = **.469**

3–D–4 Separation Alternatives

Alternate 1-A: This alternate consists of complete separation of the existing combined sewers in the North Drainage area.

Alternate 1-B: This alternate consists of complete separation of the existing combined sewers in the South Drainage area.

Alternate 1-C: This alternate consists of complete separation of the existing combined sewers in both the North and South Drainage areas.

Alternate 2-A: This alternate consists of screening and disinfection of the overflows resulting from a 2-year storm or less from the North CSO basin.

Alternate 2-B: This alternate consists of screening and disinfection of the overflows resulting from a 2-year storm or less from the South CSO basin.

Alternate 2-C: This alternate consists of screening and disinfection of the overflows resulting from a 2-year storm or less from both the North and South CSO basins.

Alternate 3-A: This alternate consists of screening of the overflows resulting from a 2-year storm or less from the North CSO basin.

Alternate 3-B: This alternate consists of screening of the overflows resulting from a 2-year storm or less from the South CSO basin.

Alternate 3-C: This alternate consists of screening of the overflows resulting from a 2-year storm or less from both the North and South CSO basins.

Ra . Method

Manning's 'n'

for a 0.5" storm

Sewer	Catchments Drained	Pipe Length	Pipe Slope	Total Area Drained	Increment Area	C	CA	Sum CA	Overland Flow Length	Overland Flow Slope	Kinematic "n"	Inlet Time	Channel Flow Time	Time of Conc	Time of Duration	Intensity	Design Q(cfs)	Effective Q(cfs)	Peak Rate MGD	Total MG	Dia Used	Flow Vel	Flow Time
	N Drainage				690.0	0.486	335.3							284.00		0.106	35.42		22.9	4.5			
	S Drainage				660.0	0.452	298.3							265.00		0.113	33.77		21.8	4.0			

Ra[illegible] Method

Manning's 'n'

for a 1" storm

Sewer	Catchments Drained	Pipe Length	Pipe Slope	Total Area Drained	Increment Area	C	CA	Sum CA	Overland Flow Length	Overland Flow Slope	Kinematic "n"	Inlet Time	Channel Flow Time	Time of Conc	Time of Duration	Intensity	Design Q(cfs)	Effective Q(cfs)	Peak Rate MGD	Total MG	Dia Used	Flow Vel	Flow Time
	N Drainage				690.0	0.486	335.3							284.00		0.211	70.85		45.8	9.0			
	S Drainage				660.0	0.452	298.3							265.00		0.226	67.54		43.7	8.0			

Ra... l Method

Manning's 'n'

for a 1.5" storm

Sewer	Catchments Drained	Pipe Length	Pipe Slope	Total Area Drained	Increment Area	C	CA	Sum CA	Overland Flow Length	Overland Flow Slope	Kinematic "n"	Inlet Time	Channel Flow Time	Time of Conc	Time of Duration	Intensity	Design Q(cfs)	Effective Q(cfs)	Peak Rate MGD	Total MG	Dia Used	Flow Vel	Flow Time
	N Drainage				690.0	0.486	335.3							284.00		0.317	106.27		68.7	13.5			
	S Drainage				660.0	0.452	298.3							265.00		0.340	101.32		65.5	12.0			

Section 4 -Evaluation of Alternatives

4-A Analysis of Approaches

Originally the City of Boonville had adopted a Presumptive Approach to evaluate CSO alternatives. The parameters to be considered were as follows:

- no more than an average of four overflow events per year will occur that do not receive the minimum treatment of primary clarification, solids and floatables disposal, and disinfection. Or,
- the elimination or capture for treatment of no less than 85% by volume of the combined sewage collected in the combined sewer system during precipitation events on a system-wide annual average basis.

With completion of the new WWTP the City has greatly reduced total CSO discharge volume from 498 MG/Yr to 136 MG/Yr representing a 73% reduction. Every gallon of CSO discharge passes through the CSO basins, which allows for primary treatment. No screening is in place for floatable control or no disinfection takes place.

The alternatives, discussed in this Section were evaluated against their ability to meet the presumptive criteria. With the measured and substantial impact of the new plant's operation, and based upon discussions with IDEM, Boonville has elected to evaluate the presumptive criteria to select an alternative. The selected plans shall include a monitoring period and protocol to demonstrate attainment of water quality standards.

The City of Boonville will demonstrate through this two year monitoring program that the CSO Basins provide capture for treatment at the WWTP, all flows up to a 1 year storm and primary treatment for flows up to a 10 year storm.

Table 4 – 1 Summary of alternatives:

Alternate 1-A	Complete separation North CSO Basin. **Does not satisfy the presumptive parameters as South CSO will continue to overflow unscreened.**
Alternate 1-B	Complete separation South CSO Basin. **Does not satisfy the presumptive parameters as North CSO will continue to overflow unscreened.**
Alternate 1-C	Complete separation Both CSO Basins. **Does satisfy the presumptive parameters.**
Alternate 2-A	Screening and disinfecting North CSO Basin. **Does not satisfy the presumptive parameters as South CSO will continne to overflow unscreened.**
Alternate 2-B	Screening and disinfecting South CSO Basin. **Does not satisfy the presumptive parameters as North CSO will continne to overflow unscreened.**
Alternate 2-C	Screening and disinfecting Both CSO Basins. **Does satisfy the presumptive parameters.**
Alternate 3-A	Screening North CSO Basin. **Does uot satisfy the presumptive parameters as South CSO will continue to overflow unscreened.**
Alternate 3-B	Screening South CSO Basin. **Does not satisfy the presumptive parameters as North CSO will contiuue to overflow unscreened.**
Alternate 3-C	Screening Both CSO Basins. **Does not satisfy the presumptive parameters as overflows will not be disinfected.**

Alternative 1-A – Complete separation North CSO Basin

Sensitive Areas – Flooding of sensitive areas by Cypress Creek would remain a continuous problem.

Basin Return Modification – Alternative includes Basin return Modification discussed in Section 5-A.

Treatment – The South CSO Basin would continue to provide primary clarification, but no screening or disinfection.

Wasteload to Cypress Creek - An average of 70 Million Gallons per year (MG/yr.) of primary treated overflow will be discharged into Cypress Creek. Unscreened and undisinfected volume remaining will be 70 Million Gallons per year.

This alternative would not satisfy the presumptive parameters.

Estimated Construction Cost	$21,420,000.00
Estimated Non-Construction Cost	$5,280,000.00
Total Project Cost	**$26,700,000.00**

			Alternative 1-A Separation North CSO	
			Construction costs	Operation Costs
Base Line CSO Volume 2005				
CSO Volume	136	MG/yr		
CSO Volume Screened	0	MG/yr		
CSO Volume Disinfected	0	MG/yr		
Basin Return Modifications			300,000.00	
North CSO Basin				
Complete Separation			26,400,000.00	
Disinfection and Screening				
Screening only				
CSO Volume	0	MG/yr		
CSO Volume Screened	0	MG/yr		
CSO Volume Disinfected	0	MG/yr		
South CSO Basin				
Complete Separation				
Disinfection and Screening				
Screening only				
CSO Volume	70	MG/yr		
CSO Volume Screened	0	MG/yr		
CSO Volume Disinfected	0	MG/yr		
Total Project Costs			26,700,000.00	
Total Volume Estimates After Improvements				
CSO Volume	70	MG/yr		
CSO Volume Screened	0	MG/yr		
CSO Volume Disinfected	0	MG/yr		

Total Treatment Cost Estimate

Year 2003 Annual Revenue Requirements per H.J. Humbaugh Report			2,189,823.00
Screening maintenance cost	0	MG/yr	-
	$ 1.00	/1000 gal	
Disinfection maintenance cost	0	0	-
	$ 2.00	/1000 gal	
CSO Demonstration monitoring			150,000.00
Debt Service at 5% Bond Issue	CRF =	0.08024259	2,142,477.08
Debt Service Reserve (at 25%)			535,619.27
Total Estimated Annual Revenue Requirements			5,017,919.35
Less Current Revenue			(2,189,823.00)
Increase required			2,828,096.35
Percent increase			129%
Estimated monthly rate for 5,000 gallons			78.16

Present Worth Analysis

Present Worth Construction costs		26,700,000.00
Present Worth Operation costs	pwf= 10.29	51,634,390.09
Total Present Worth		78,334,390.09

Alternative 1-B – Complete separation South CSO Basin

Sensitive Areas – Flooding of sensitive areas by Cypress Creek would remain a continuous problem.

Basin Return Modification – Alternative includes Basin return Modification discussed in Section 5-A.

Treatment – The North CSO Basin would continue to provide primary clarification, but no screening or disinfection.

Wasteload to Cypress Creek - An average of 66 Million Gallons per year (MG/yr.) of primary treated overflow will be discharged into Cypress Creek. Unscreened and undisinfected volume remaining will be 66 Million Gallons per year.

This alternative would not satisfy the presumptive parameters.

Estimated Construction Cost	$30,540,000.00
Estimated Non-Construction Cost	$7,560,000.00
Total Project Cost	**$38,100,000.00**

			Alternative 1-B Separation North CSO	
			Construction costs	Operation Costs
Base Line CSO Volume 2005				
CSO Volume	136	MG/yr		
CSO Volume Screened	0	MG/yr		
CSO Volume Disinfected	0	MG/yr		
Basin Return Modifications			300,000.00	
North CSO Basin				
Complete Separation				
Disinfection and Screening				
Screening only				
CSO Volume	66	MG/yr		
CSO Volume Screened	0	MG/yr		
CSO Volume Disinfected	0	MG/yr		
South CSO Basin				
Complete Separation			37,800,000.00	
Disinfection and Screening				
Screening only				
CSO Volume	0	MG/yr		
CSO Volume Screened	0	MG/yr		
CSO Volume Disinfected	0	MG/yr		
Total Project Costs			38,100,000.00	
Total Volume Estimates After Improvements				
CSO Volume	66	MG/yr		
CSO Volume Screened	0	MG/yr		
CSO Volume Disinfected	0	MG/yr		

Total Treatment Cost Estimate			
Year 2003 Annual Revenue Requirements per H.J. Humbaugh Report			2,189,823.00
Screening maintenance cost	0 $ 1.00	MG/yr /1000 gal	-
Disinfection maintenance cost	0 $ 2.00	0 /1000 gal	-
CSO Demonstration monitoring			150,000.00
Debt Service at 5% Bond issue	CRF =	0.08024259	3,057,242.57
Debt Service Reserve (at 25%)			764,310.64
Total Estimated Annual Revenue Requirements			6,161,376.22
Less Current Revenue			(2,189,823.00)
Increase required			3,971,553.22
Percent increase			181%
Estimated monthly rate for 5,000 gallons			95.97

Present Worth Analysis		
Present Worth Construction costs		38,100,000.00
Present Worth Operation costs	pwf= 10.29	63,400,561.26
Total Present Worth		101,500,561.26

Alternative 1-C – Complete separation Both CSO Basins

Sensitive Areas – Flooding of sensitive areas by Cypress Creek would remain a continuous problem.

Treatment – No CSO overflows would remain.

Wasteload to Cypress Creek - No overflows would remain.

This alternative will satisfy the presumptive parameters.

Estimated Construction Cost	$51,360,000.00
Estimated Non-Construction Cost	$12,840,000.00
Total Project Cost	**$64,200,000.00**

			Alternative 1-C Separation North CSO	
			Construction costs	Operation Costs
Base Line CSO Volume 2005				
CSO Volume	136	MG/yr		
CSO Volume Screened	0	MG/yr		
CSO Volume Disinfected	0	MG/yr		
Basin Return Modifications				
North CSO Basin				
Complete Separation			26,400,000.00	
Disinfection and Screening				
Screening only				
CSO Volume	0	MG/yr		
CSO Volume Screened	0	MG/yr		
CSO Volume Disinfected	0	MG/yr		
South CSO Basin				
Complete Separation			37,800,000.00	
Disinfection and Screening				
Screening only				
CSO Volume	0	MG/yr		
CSO Volume Screened	0	MG/yr		
CSO Volume Disinfected	0	MG/yr		
Total Project Costs			64,200,000.00	
Total Volume Estimates After Improvements				
CSO Volume	0	MG/yr		
CSO Volume Screened	0	MG/yr		
CSO Volume Disinfected	0	MG/yr		

Total Treatment Cost Estimate

Year 2003 Annual Revenue Requirements per H.J. Humbaugh Report				2,189,823.00
Screening maintenance cost	0	MG/yr		-
	\$ 1.00	/1000 gal		
Disinfection maintenance cost	0	0		-
	\$ 2.00	/1000 gal		
CSO Demonstration monitoring				150,000.00
Debt Service at 5% Bond Issue	CRF =	0.08024259		5,151,574.10
Debt Service Reserve (at 25%)				1,287,893.52
Total Estimated Annual Revenue Requirements				8,779,290.62
Less Current Revenue				(2,189,823.00)
Increase required				6,589,467.62
Percent increase				301%
Estimated monthly rate for 5,000 gallons				136.75

Present Worth Analysis

Present Worth Construction costs		64,200,000.00
Present Worth Operation costs	pwf= 10.29	90,338,900.51
Total Present Worth		154,538,900.51

Alternative 2-A – Screening and Disinfection North CSO Basin

Sensitive Areas – Flooding of sensitive areas by Cypress Creek would remain a continuous problem.

Basin Return Modification – Alternative includes Basin return Modification discussed in Section 5-A.

Treatment – The North CSO would be equipped with screens to control floatables and with chlorination/dechlorination equipment to disinfect CSO discharges. Both North and South CSO's would continue to provide primary clarification.

Wasteload to Cypress Creek - An average of 136 Million Gallons per year (MG/yr.) of primary treated overflow will be discharged into Cypress Creek. Unscreened and undisinfected volume remaining will be 66 Million Gallons per year.

This alternative would not satisfy the presumptive parameters.

Estimated Construction Cost	
Basin Return Modification	$300,000.00
Screening	$500,000.00
Disinfection	$1,400,000.00
Sub-Total Construction Cost	$2,200,000.00
Estimated Non-Construction Cost	$380,000.00
Total Project Cost	**$2,580,000.00**

Alternative 2-A
Separation North CSO

			Construction costs	Operation Costs
Base Line CSO Volume 2005				
CSO Volume	136	MG/yr		
CSO Volume Screened	0	MG/yr		
CSO Volume Disinfected	0	MG/yr		
Basin Return Modifications			300,000.00	
North CSO Basin				
Complete Separation				
Disinfection and Screening			2,280,000.00	
Screening only				
CSO Volume	70	MG/yr		
CSO Volume Screened	70	MG/yr		
CSO Volume Disinfected	70	MG/yr		
South CSO Basin				
Complete Separation				
Disinfection and Screening				
Screening only				
CSO Volume	66	MG/yr		
CSO Volume Screened	0	MG/yr		
CSO Volume Disinfected	0	MG/yr		
Total Project Costs			2,580,000.00	
Total Volume Estimates After Improvements				
CSO Volume	136	MG/yr		
CSO Volume Screened	70	MG/yr		
CSO Volume Disinfected	70	MG/yr		

Total Treatment Cost Estimate

Year 2003 Annual Revenue Requirements per H.J. Humbaugh Report			2,189,823.00
Screening maintenance cost	70	MG/yr	70,000.00
	$ 1.00	/1000 gal	
Disinfection maintenance cost	70	0	140,000.00
	$ 2.00	/1000 gal	
CSO Demonstration monitoring			150,000.00
Debt Service at 5% Bond issue	CRF =	0.08024259	207,025.87
Debt Service Reserve (at 25%)			51,756.47
Total Estimated Annual Revenue Requirements			2,808,605.34
Less Current Revenue			(2,189,823.00)
Increase required			618,782.34
Percent increase			28%
Estimated monthly rate for 5,000 gallons			43.75

Present Worth Analysis

Present Worth Construction costs		2,580,000.00
Present Worth Operation costs	pwf= 10.29	28,900,548.99
Total Present Worth		31,480,548.99

Alternative 2-B – Screening and Disinfection South CSO Basin

Sensitive Areas – Flooding of sensitive areas by Cypress Creek would remain a continuous problem.

Basin Return Modification – Alternative includes Basin return Modification discussed in Section 5-A.

Treatment – The South CSO would be equipped with screens to control floatables and with chlorination/dechlorination equipment to disinfect CSO discharges. Both North and South CSO's would continue to provide primary clarification.

Wasteload to Cypress Creek - An average of 136 Million Gallons per year (MG/yr.) of primary treated overflow will be discharged into Cypress Creek. Unscreened and undisinfected volume remaining will be 70 Million Gallons per year.

This alternative would not satisfy the presumptive parameters.

Estimated Construction Cost	
Basin Return Modification	$300,000.00
Screening	$500,000.00
Disinfection	$1,400,000.00
Sub-Total Construction Cost	$2,200,000.00
Estimated Non-Construction Cost	$380,000.00
Total Project Cost	**$2,580,000.00**

			Alternative 2-B Separation North CSO Construction costs	Operation Costs
Base Line CSO Volume 2005				
CSO Volume	136	MG/yr		
CSO Volume Screened	0	MG/yr		
CSO Volume Disinfected	0	MG/yr		
Basin Return Modifications			300,000.00	
North CSO Basin				
Complete Separation				
Disinfection and Screening				
Screening only				
CSO Volume	70	MG/yr		
CSO Volume Screened		MG/yr		
CSO Volume Disinfected		MG/yr		
South CSO Basin				
Complete Separation				
Disinfection and Screening			2,280,000.00	
Screening only				
CSO Volume	66	MG/yr		
CSO Volume Screened	66	MG/yr		
CSO Volume Disinfected	66	MG/yr		
Total Project Costs			2,580,000.00	
Total Volume Estimates After Improvements				
CSO Volume	136	MG/yr		
CSO Volume Screened	66	MG/yr		
CSO Volume Disinfected	66	MG/yr		

Total Treatment Cost Estimate

Year 2003 Annual Revenue Requirements per H.J. Humbaugh Report				2,189,823.00
Screening maintenance cost	66 $ 1.00	MG/yr /1000 gal		66,000.00
Disinfection maintenance cost	66 $ 2.00	0 /1000 gal		132,000.00
CSO Demonstration monitoring				150,000.00
Debt Service at 5% Bond issue	CRF =	0.08024259		207,025.87
Debt Service Reserve (at 25%)				51,756.47
Total Estimated Annual Revenue Requirements				2,796,605.34
Less Current Revenue				(2,189,823.00)
Increase required				606,782.34
Percent Increase				28%
Estimated monthly rate for 5,000 gallons				43.56

Present Worth Analysis

Present Worth Construction costs		2,580,000.00
Present Worth Operation costs	pwf= 10.29	28,777,068.99
Total Present Worth		31,357,068.99

Alternative 2-C – Screening and Disinfection Both CSO Basins

Sensitive Areas – Flooding of sensitive areas by Cypress Creek would remain a continuous problem.

Basin Return Modification – Alternative includes Basin return Modification discussed in Section 5-A.

Treatment – Both CSO's would be equipped with screens to control floatables and with chlorination/dechlorination equipment to disinfect CSO discharges. Both North and South CSO's would continue to provide primary clarification.

Wasteload to Cypress Creek - An average of 136 Million Gallons per year (MG/yr.) of primary treated overflow will be discharged into Cypress Creek. Unscreened and undisinfected volume remaining will be 0 Million Gallons per year.

This alternative would satisfy the presumptive parameters.

Estimated Construction Cost	
Basin Return Modification	$300,000.00
Screening	$1,000,000.00
Disinfection	$2,800,000.00
Sub-Total Construction Cost	$4,100,000.00
Estimated Non-Construction Cost	$760,000.00
Total Project Cost	**$4,860,000.00**

			Alternative 2-C Separation North CSO	
			Construction costs	Operation Costs
Base Line CSO Volume 2005				
CSO Volume	136	MG/yr		
CSO Volume Screened	0	MG/yr		
CSO Volume Disinfected	0	MG/yr		
Basin Return Modifications			300,000.00	
North CSO Basin				
Complete Separation				
Disinfection and Screening			2,280,000.00	
Screening only				
CSO Volume	70	MG/yr		
CSO Volume Screened	70	MG/yr		
CSO Volume Disinfected	70	MG/yr		
South CSO Basin				
Complete Separation				
Disinfection and Screening				
Screening only				
CSO Volume	66	MG/yr	2280000	
CSO Volume Screened	66	MG/yr		
CSO Volume Disinfected	66	MG/yr		
Total Project Costs			4,860,000.00	
Total Volume Estimates After Improvements				
CSO Volume	136	MG/yr		
CSO Volume Screened	136	MG/yr		
CSO Volume Disinfected	136	MG/yr		

Total Treatment Cost Estimate			
Year 2003 Annual Revenue Requirements per H.J. Humbaugh Report			2,189,823.00
Screening maintenance cost	136 $ 1.00	MG/yr /1000 gal	136,000.00
Disinfection maintenance cost	136 $ 2.00	0 /1000 gal	272,000.00
CSO Demonstration monitoring			150,000.00
Debt Service at 5% Bond issue	CRF =	0.08024259	389,978.97
Debt Service Reserve (at 25%)			97,494.74
Total Estimated Annual Revenue Requirements			3,235,296.72
Less Current Revenue			(2,189,823.00)
Increase required			1,045,473.72
Percent increase			48%
Estimated monthly rate for 5,000 gallons			50.39

Present Worth Analysis		
Present Worth Construction costs		4,860,000.00
Present Worth Operation costs	pwf= 10.29	33,291,203.22
Total Present Worth		38,151,203.22

Alternative 3-A – Screening North CSO Basin

Sensitive Areas – Flooding of sensitive areas by Cypress Creek would remain a continuous problem.

Basin Return Modification – Alternative includes Basin return Modification discussed in Section 5-A.

Treatment – The North CSO would be equipped with screening to control floatables. Both North and South Basins would continue to provide primary clarification. No disinfection would be provided.

Wasteload to Cypress Creek - An average of 136 Million Gallons per year (MG/yr.) of primary treated overflow will be discharged into Cypress Creek. Unscreened volume remaining will be 66 Million Gallons per year. Undisinfected volume remaining will be 136 Million Gallons per year.

This alternative would not satisfy the presumptive parameters.

Estimated Construction Cost	$800,000.00
Estimated Non-Construction Cost	$100.000.00
Total Project Cost	**$900,000.00**

			Alternative 3-A Separation North CSO	
			Construction costs	Operation Costs
Base Line CSO Volume 2005				
CSO Volume	136	MG/yr		
CSO Volume Screened	0	MG/yr		
CSO Volume Disinfected	0	MG/yr		
Basin Return Modifications			300,000.00	
North CSO Basin				
Complete Separation				
Disinfection and Screening				
Screening only			600,000.00	
CSO Volume	70	MG/yr		
CSO Volume Screened	70	MG/yr		
CSO Volume Disinfected		MG/yr		
South CSO Basin				
Complete Separation				
Disinfection and Screening				
Screening only				
CSO Volume	66	MG/yr		
CSO Volume Screened	0	MG/yr		
CSO Volume Disinfected	0	MG/yr		
Total Project Costs			900,000.00	
Total Volume Estimates After Improvements				
CSO Volume	136	MG/yr		
CSO Volume Screened	70	MG/yr		
CSO Volume Disinfected	0	MG/yr		

Total Treatment Cost Estimate				
Year 2003 Annual Revenue Requirements per H.J. Humbaugh Report				2,189,823.00
Screening maintenance cost	70 $ 1.00	MG/yr /1000 gal		70,000.00
Disinfection maintenance cost	0 $ 2.00	0 /1000 gal		-
CSO Demonstration monitoring				150,000.00
Debt Service at 5% Bond issue	CRF =	0.08024259		72,218.33
Debt Service Reserve (at 25%)				18,054.58
Total Estimated Annual Revenue Requirements				2,500,095.91
Less Current Revenue				(2,189,823.00)
Increase required				310,272.91
Percent increase				14%
Estimated monthly rate for 5,000 gallons				38.94

Present Worth Analysis		
Present Worth Construction costs		900,000.00
Present Worth Operation costs	pwf= 10.29	25,725,986.92
Total Present Worth		26,625,986.92

Alternative 3-B – Screening South CSO Basin

Sensitive Areas – Flooding of sensitive areas by Cypress Creek would remain a continuous problem.

Basin Return Modification – Alternative includes Basin return Modification discussed in Section 5-A.

Treatment – The South CSO would be equipped with screening to control floatables. Both North and South Basins would continue to provide primary clarification. No disinfection would be provided.

Wasteload to Cypress Creek - An average of 136 Million Gallons per year (MG/yr.) of primary treated overflow will be discharged into Cypress Creek. Unscreened volume remaining will be 70 Million Gallons per year. Undisinfected volume remaining will be 136 Million Gallons per year.

This alternative would not satisfy the presumptive parameters.

Estimated Construction Cost	$800,000.00
Estimated Non-Construction Cost	$100,000.00
Total Project Cost	**$900,000.00**

			Alternative 3-B Separation North CSO	
			Construction costs	Operation Costs
Base Line CSO Volume 2005				
CSO Volume	136	MG/yr		
CSO Volume Screened	0	MG/yr		
CSO Volume Disinfected	0	MG/yr		
Basin Return Modifications			300,000.00	
North CSO Basin				
Complete Separation				
Disinfection and Screening				
Screening only				
CSO Volume	70	MG/yr		
CSO Volume Screened	0	MG/yr		
CSO Volume Disinfected	0	MG/yr		
South CSO Basin				
Complete Separation				
Disinfection and Screening				
Screening only			600000	
CSO Volume	66	MG/yr		
CSO Volume Screened	66	MG/yr		
CSO Volume Disinfected	0	MG/yr		
Total Project Costs			900,000.00	
Total Volume Estimates After Improvements				
CSO Volume	136	MG/yr		
CSO Volume Screened	66	MG/yr		
CSO Volume Disinfected	0	MG/yr		

Total Treatment Cost Estimate

Year 2003 Annual Revenue Requirements per H.J. Humbaugh Report			2,189,823.00
Screening maintenance cost	66	MG/yr	66,000.00
	$ 1.00	/1000 gal	
Disinfection maintenance cost	0	0	-
	$ 2.00	/1000 gal	
CSO Demonstration monitoring			150,000.00
Debt Service at 5% Bond Issue	CRF =	0.08024259	72,218.33
Debt Service Reserve (at 25%)			18,054.58
Total Estimated Annual Revenue Requirements			2,496,095.91
Less Current Revenue			(2,189,823.00)
Increase required			306,272.91
Percent increase			14%
Estimated monthly rate for 5,000 gallons			38.88

Present Worth Analysis

Present Worth Construction costs		900,000.00
Present Worth Operation costs	pwf= 10.29	25,684,826.92
Total Present Worth		26,584,826.92

Alternative 3-C – Screening Both CSO Basins

Sensitive Areas – Flooding of sensitive areas by Cypress Creek would remain a continuous problem.

Basin Return Modification – Alternative includes Basin return Modification discussed in Section 5-A.

Treatment – Both Northand South CSO's would be equipped with screening to control floatables. Both North and South Basins would continue to provide primary clarification. No disinfection would be provided.

Wasteload to Cypress Creek - An average of 136 Million Gallons per year (MG/yr.) of primary treated overflow will be discharged into Cypress Creek. Unscreened volume remaining will be 0 Million Gallons per year. Undisinfected volume remaining will be 136 Million Gallons per year.

This alternative would not satisfy the presumptive parameters.

Estimated Construction Cost	$1,300,000.00
Estimated Non-Construction Cost	$200,000.00
Total Project Cost	**$1,500,000.00**

			Alternative 3-C Separation North CSO	
			Construction costs	Operation Costs
Base Line CSO Volume 2005				
CSO Volume	136	MG/yr		
CSO Volume Screened	0	MG/yr		
CSO Volume Disinfected	0	MG/yr		
Basin Return Modifications			300,000.00	
North CSO Basin				
Complete Separation				
Disinfection and Screening				
Screening only			600,000.00	
CSO Volume	70	MG/yr		
CSO Volume Screened	70	MG/yr		
CSO Volume Disinfected	0	MG/yr		
South CSO Basin				
Complete Separation				
Disinfection and Screening				
Screening only			600,000.00	
CSO Volume	66	MG/yr		
CSO Volume Screened	66	MG/yr		
CSO Volume Disinfected	0	MG/yr		
Total Project Costs			1,500,000.00	
Total Volume Estimates After Improvements				
CSO Volume	136	MG/yr		
CSO Volume Screened	136	MG/yr		
CSO Volume Disinfected	0	MG/yr		

Total Treatment Cost Estimate

Year 2003 Annual Revenue Requirements per H.J. Humbaugh Report				2,189,823.00
Screening maintenance cost	136	MG/yr		136,000.00
	$ 1.00	/1000 gal		
Disinfection maintenance cost	0	0		-
	$ 2.00	/1000 gal		
CSO Demonstration monitoring				150,000.00
Debt Service at 5% Bond Issue	CRF =	0.08024259		120,363.88
Debt Service Reserve (at 25%)				30,090.97
Total Estimated Annual Revenue Requirements				2,626,277.85
Less Current Revenue				(2,189,823.00)
Increase required				436,454.85
Percent increase				20%
Estimated monthly rate for 5,000 gallons				40.91

Present Worth Analysis		
Present Worth Construction costs		1,500,000.00
Present Worth Operation costs	pwf= 10.29	27,024,399.09
Total Present Worth		28,524,399.09

Section 4 -Evaluation of Alternatives

4-A Analysis of Approaches

The City of Boonville's has adopted a Presumptive Approach to evaluate CSO alternatives. The parameters to be considered are as follows:

- no more than an average of four overflow events per year will occur that do not receive the minimum treatment of primary clarification, solids and floatables disposal, and disinfection. Or,
- the elimination or capture for treatment of no less than 85% by volume of the combined sewage collected in the combined sewer system during precipitation events on a system-wide annual average basis.

With completion of the new WWTP the City will have greatly reduced total CSO discharge volume from 498 MG/Yr receiving primary treatment to 280 MG/Yr receiving primary treatment, representing a 44% reduction. Every gallon of CSO discharge passes through the CSO basins, which allows for primary treatment. No screening is in place for floatable control or no disinfection takes place.

To meet the presumptive goals the following alternatives are to be considered.

Replaced 2-28-06

Table 4 – 1 Summary of alternatives:

Alternate 1-A	Complete separation North CSO Basin. **Does not satisfy the presumptive parameters.**
Alternate 1-B	Complete separation South CSO Basin. **Does not satisfy the presumptive parameters.**
Alternate 1-C	Complete separation Both CSO Basins. **Does satisfy the presumptive parameters.**
Alternate 2-A	Screening and disinfecting North CSO Basin. **Does not satisfy the presumptive parameters.**
Alternate 2-B	Screening and disinfecting South CSO Basin. **Does not satisfy the presumptive parameters.**
Alternate 2-C	Screening and disinfecting Both CSO Basins. **Does satisfy the presumptive parameters.**
Alternate 3-A	Screening North CSO Basin. **Does not satisfy the presnmptive parameters.**
Alternate 3-B	Screening South CSO Basin. **Does not satisfy the presumptive parameters.**
Alternate 3-C	Screening Both CSO Basins. **Does not satisfy the presumptive parameters.**

Alternative 1-A – Complete separation North CSO Basin

Sensitive Areas – Flooding of sensitive areas by Cypress Creek would remain a continuous problem.

Treatment – The South CSO Basin would continue to provide primary clarification, but no screening or disinfection.

Wasteload to Cypress Creek - An average of 156 Million Gallons per year (MG/yr.) of primary treated overflow will be discharged into Cypress Creek. Unscreened and undisinfected volume remaining will be 156 Million Gallons per year.

This alternative would not satisfy the presumptive parameters.

Estimated Construction Cost	$21,120,000.00
Estimated Non-Construction Cost	$5,280,000.00
Total Project Cost	**$26,400,000.00**

		Alternate 1-A Separation North CSO	
		Construction Costs	Operation Costs
Base Line CSO Volume Estimates after new plant			
CSO Volume	280 MG/yr		
CSO Volume screened	0 MG/yr		
CSO Volume disinfected	0 MG/yr		
North CSO Basin			
Complete Separation		26,400,000.00	
Disnifection and screening		-	
Screening only		-	
CSO Volume	0 MG/yr		
CSO Volume screened	0 MG/yr		
CSO Volume disinfected	0 MG/yr		
South CSO Basin			
Complete Separation		-	
Disnifection and screening		-	
Screening only		-	
CSO Volume	156 MG/yr		
CSO Volume screened	0 MG/yr		
CSO Volume disinfected	0 MG/yr		
Total Project Costs		$ 26,400,000.00	
Total Volume Estimates after CSO improvements			
CSO Volume remaining	156 MG/yr		
CSO Volume screened	0 MG/yr		
CSO Volume disinfected	0 MG/yr		
Total Treatment Cost Estimate			
Year 2003 Annual Revenue Requirements per H.J Humbaugh Report			2,189,823.00
Screening maintneance cost	0 MG/yr		-
$ 1.00 /1000 gal			
Disinfection Treatment Cost	0 MG/yr		-
$ 2.00 /1000 gal			
MS4 annual cost			150,000.00
Debt service LTCP 5% Bond issue CRF =	0.08024259		2,118,404.38
Debt service reserve (at 25%)			529,601.09
Total Estimated Annual Revenue Requirements			4,987,828.47
Less Current Revenue			(2,189,823.00)
Increase required			2,798,005.47
Percent increase			128%
Estimated monthly rate for 5,000 gallons			77.90
Present Worth Analysis			
Present Worth Construction Costs			26,400,000.00
Presnet Worth Operation Costs (pwf =	10.29		51,324,754.96
Total Present Worth			77,724,754.96

Alternative 1-B – Complete separation South CSO Basin

Sensitive Areas – Flooding of sensitive areas by Cypress Creek would remain a continuous problem.

Treatment – The North CSO Basin would continue to provide primary clarification, but no screening or disinfection.

Wasteload to Cypress Creek - An average of 124 Million Gallons per year (MG/yr.) of primary treated overflow will be discharged into Cypress Creek. Unscreened and undisinfected volume remaining will be 124 Million Gallons per year.

This alternative would not satisfy the presumptive parameters.

Estimated Construction Cost	$30,240,000.00
Estimated Non-Construction Cost	$7,560,000.00
Total Project Cost	**$37,800,000.00**

		Alternate 1-B Separation South CSO	
		Construction Costs	Operation Costs
Base Line CSO Volume Estimates after new plant			
CSO Volume	280 MG/yr		
CSO Volume screened	0 MG/yr		
CSO Volume disinfected	0 MG/yr		
North CSO Basin			
Complete Separation			
Disnifection and screening		-	
Screening only		-	
CSO Volume	124 MG/yr		
CSO Volume screened	0 MG/yr		
CSO Volume disinfected	0 MG/yr		
South CSO Basin			
Complete Separation		37,800,000.00	
Disnifection and screening		-	
Screening only		-	
CSO Volume	0 MG/yr		
CSO Volume screened	0 MG/yr		
CSO Volume disinfected	0 MG/yr		
Total Project Costs		$ 37,800,000.00	
Total Volume Estimates after CSO improvements			
CSO Volume remaining	124 MG/yr		
CSO Volume screened	0 MG/yr		
CSO Volume disinfected	0 MG/yr		
Total Treatment Cost Estimate			
Year 2003 Annual Revenue Requirements per H.J Humbaugh Report			2,189,823.00
Screening maintneance cost	0 MG/yr		-
$ 1.00 /1000 gal			
Disinfection Treatment Cost	0 MG/yr		-
$ 2.00 /1000 gal			
MS4 annual cost			150,000.00
Debt service LTCP 5% Bond issue CRF =	0.08024259		3,033,169.90
Debt service reserve (at 25%)			758,292.48
Total Estimated Annual Revenue Requirements			6,131,285.38
Less Current Revenue			(2,189,823.00)
Increase required			3,941,462.38
Percent increase			180%
Estimated monthly rate for 5,000 gallons			95.76
Present Worth Analysis			
Present Worth Construction Costs			37,800,000.00
Presnet Worth Operation Costs (pwf =	10.29		63,090,926.53
Total Present Worth			100,890,926.53

Alternative 1-C – Complete separation Both CSO Basins

Sensitive Areas – Flooding of sensitive areas by Cypress Creek would remain a continuous problem.

Treatment – No CSO overflows would remain.

Wasteload to Cypress Creek - No overflows would remain.

This alternative will satisfy the presumptive parameters.

Estimated Construction Cost	$51,360,000.00
Estimated Non-Construction Cost	$12,840,000.00
Total Project Cost	**$64,200,000.00**

		Alternate 1-C Separation North and South CSO Construction Costs	Operation Costs
Base Line CSO Volume Estimates after new plant			
CSO Volume	280 MG/yr		
CSO Volume screened	0 MG/yr		
CSO Volume disinfected	0 MG/yr		
North CSO Basin			
Complete Separation		26,400,000.00	
Disnifection and screening		-	
Screening only		-	
CSO Volume	0 MG/yr		
CSO Volume screened	0 MG/yr		
CSO Volume disinfected	0 MG/yr		
South CSO Basin			
Complete Separation		37,600,000.00	
Disnifection and screening		-	
Screening only		-	
CSO Volume	0 MG/yr		
CSO Volume screened	0 MG/yr		
CSO Volume disinfected	0 MG/yr		
Total Project Costs		$ 64,200,000.00	

Total Volume Estimates after CSO improvements		
CSO Volume remaining	0 MG/yr	
CSO Volume screened	0 MG/yr	
CSO Volume disinfected	0 MG/yr	

		Operation Costs
Total Treatment Cost Estimate		
Year 2003 Annual Revenue Requirements per H.J Humbaugh Report		2,189,823.00
Screening maintneance cost	0 MG/yr	-
$ 1.00 /1000 gal		
Disinfection Treatment Cost	0 MG/yr	-
$ 2.00 /1000 gal		
MS4 annual cost		150,000.00
Debt service LTCP 5% Bond issue CRF =	0.08024259	5,151,574.28
Debt service reserve (at 25%)		1,287,893.57
Total Estimated Annual Revenue Requirements		8,779,290.85
Less Current Revenue		(2,189,823.00)
Increase required		6,589,467.85
Percent increase		301%
Estimated monthly rate for 5,000 gallons		137.11

Present Worth Analysis		
Present Worth Construction Costs		64,200,000.00
Presnet Worth Operation Costs (pwf =	10.29	90,338,902.82
Total Present Worth		154,538,902.82

Alternative 2-A – Screening and Disinfection North CSO Basin

Sensitive Areas – Flooding of sensitive areas by Cypress Creek would remain a continuous problem.

Treatment – The North CSO would be equipped with screens to control floatables and with chlorination/dechlorination equipment to disinfect CSO discharges. Both North and South CSO's would continue to provide primary clarification.

Wasteload to Cypress Creek - An average of 280 Million Gallons per year (MG/yr.) of primary treated overflow will be discharged into Cypress Creek. Unscreened and undisinfected volume remaining will be 124 Million Gallons per year.

This alternative would not satisfy the presumptive parameters.

Estimated Construction Cost	
Screening	$500,000.00
Disinfection	$1,400,000.00
Sub-Total Construction Cost	$1,900,000.00
Estimated Non-Construction Cost	$380,000.00
Total Project Cost	**$2,280,000.00**

		Alternate 2-A Screening and Disinfection North CSO	
		Construction Costs	Operation Costs
Base Line CSO Volume Estimates after new plant			
CSO Volume	280 MG/yr		
CSO Volume screened	0 MG/yr		
CSO Volume disinfected	0 MG/yr		
North CSO Basin			
Complete Separation			
Disnifection and screening		2,280,000.00	
Screening only		-	
CSO Volume	156 MG/yr		
CSO Volume screened	156 MG/yr		
CSO Volume disinfected	156 MG/yr		
South CSO Basin			
Complete Separation			
Disnifection and screening		-	
Screening only		-	
CSO Volume	124 MG/yr		
CSO Volume screened	0 MG/yr		
CSO Volume disinfected	0 MG/yr		
Total Project Costs		$ 2,280,000.00	
Total Volume Estimates after CSO improvements			
CSO Volume remaining	280 MG/yr		
CSO Volume screened	156 MG/yr		
CSO Volume disinfected	156 MG/yr		
Total Treatment Cost Estimate			
Yeer 2003 Annual Revenue Requirements per H.J Humbaugh Report			2,189,823.00
Screening maintneance cost	156 MG/yr		156,000.00
$ 1.00 /1000 gal			
Disinfection Treatment Cost	156 MG/yr		312,000.00
$ 2.00 /1000 gal			
MS4 annual cost			150,000.00
Debt service LTCP 5% Bond issue CRF =	0.08024259		182,953.11
Debt service reserve (at 25%)			45,738.28
Total Estimated Annual Revenue Requirements			3,036,514.38
Less Current Revenue			(2,189,823.00)
Increase required			846,691.38
Percent increase			39%
Estimated monthly rate for 5,000 gallons			47.42
Present Worth Analysis			
Present Worth Construction Costs			2,280,000.00
Presnet Worth Operation Costs (pwf =	10.29		31,245,732.99
Total Present Worth			33,525,732.99

Alternative 2-B – Screening and Disinfection South CSO Basin

Sensitive Areas – Flooding of sensitive areas by Cypress Creek would remain a continuous problem.

Treatment – The South CSO would be equipped with screens to control floatables and with chlorination/dechlorination equipment to disinfect CSO discharges. Both North and South CSO's would continue to provide primary clarification.

Wasteload to Cypress Creek - An average of 280 Million Gallons per year (MG/yr.) of primary treated overflow will be discharged into Cypress Creek. Unscreened and undisinfected volume remaining will be 156 Million Gallons per year.

This alternative would not satisfy the presumptive parameters.

Estimated Construction Cost	
Screening	$500,000.00
Disinfection	$1,400,000.00
Sub-Total Construction Cost	$1,900,000.00
Estimated Non-Construction Cost	$380,000.00
Total Project Cost	**$2,280,000.00**

		Alternate 2-B Screening and Disinfection South CSO	
		Construction Costs	Operation Costs
Base Line CSO Volume Estimates after new plant			
CSO Volume	280 MG/yr		
CSO Volume screened	0 MG/yr		
CSO Volume disinfected	0 MG/yr		
North CSO Basin			
Complete Separation			
Disnifection and screening			
Screening only		-	
CSO Volume	156 MG/yr		
CSO Volume screened	0 MG/yr		
CSO Volume disinfected	0 MG/yr		
South CSO Basin			
Complete Separation			
Disnifection and screening		2,280,000.00	
Screening only		-	
CSO Volume	124 MG/yr		
CSO Volume screened	124 MG/yr		
CSO Volume disinfected	124 MG/yr		
Total Project Costs		$ 2,280,000.00	
Total Volume Estimates after CSO improvements			
CSO Volume remaining	280 MG/yr		
CSO Volume screened	124 MG/yr		
CSO Volume disinfected	124 MG/yr		
Total Treatment Cost Estimate			
Year 2003 Annual Revenue Requirements per H.J Humbaugh Report			2,189,823.00
Screening maintneance cost $ 1.00 /1000 gal	124 MG/yr		124,000.00
Disinfection Treatment Cost $ 2.00 /1000 gal	124 MG/yr		248,000.00
MS4 annual cost			150,000.00
Debt service LTCP 5% Bond issue CRF =	0.08024259		182,953.11
Debt service reserve (at 25%)			45,738.28
Total Estimated Annual Revenue Requirements			2,940,514.38
Less Current Revenue			(2,189,823.00)
Increase required			750,691.38
Percent increase			34%
Estimated monthly rate for 5,000 gallons			45.92
Present Worth Analysis			
Present Worth Construction Costs			2,280,000.00
Presnet Worth Operation Costs (pwf =	10.29		30,257,892.99
Total Present Worth			32,537,892.99

Alternative 2-C – Screening and Disinfection Both CSO Basins

Sensitive Areas – Flooding of sensitive areas by Cypress Creek would remain a continuous problem.

Treatment – Both CSO's would be equipped with screens to control floatables and with chlorination/dechlorination equipment to disinfect CSO discharges. Both North and South CSO's would continue to provide primary clarification.

Wasteload to Cypress Creek - An average of 280 Million Gallons per year (MG/yr.) of primary treated overflow will be discharged into Cypress Creek. Unscreened and undisinfected volume remaining will be 0 Million Gallons per year.

This alternative would satisfy the presumptive parameters.

Estimated Construction Cost	
Screening	$1,000,000.00
Disinfection	$2,800,000.00
Sub-Total Construction Cost	$3,800,000.00
Estimated Non-Construction Cost	$760,000.00
Total Project Cost	**$4,560,000.00**

		Alternate 2-C Screening and Disinfection North and South CSO Construction Costs	Operation Costs
Base Line CSO Volume Estimates after new plant			
CSO Volume	280 MG/yr		
CSO Volume screened	0 MG/yr		
CSO Volume disinfected	0 MG/yr		
North CSO Basin			
Complete Separation			
Disnifection and screening		2,280,000.00	
Screening only		-	
CSO Volume	156 MG/yr		
CSO Volume screened	156 MG/yr		
CSO Volume disinfected	156 MG/yr		
South CSO Basin			
Complete Separation			
Disnifection and screening		2,280,000.00	
Screening only		-	
CSO Volume	124 MG/yr		
CSO Volume screened	124 MG/yr		
CSO Volume disinfected	124 MG/yr		
Total Project Costs		$ 4,560,000.00	
Total Volume Estimates after CSO improvements			
CSO Volume remaining	280 MG/yr		
CSO Volume screened	280 MG/yr		
CSO Volume disinfected	280 MG/yr		
Total Treatment Cost Estimate			
Year 2003 Annual Revenue Requirements per H.J Humbaugh Report			2,189,823.00
Screening maintneance cost $ 1.00 /1000 gal	280 MG/yr		280,000.00
Disinfection Treatment Cost $ 2.00 /1000 gal	280 MG/yr		560,000.00
MS4 annual cost			150,000.00
Debt service LTCP 5% Bond Issue CRF =	0.08024259		365,906.21
Debt service reserve (at 25%)			91,476.55
Total Estimated Annual Revenue Requirements			3,637,205.76
Less Current Revenue			(2,189,823.00)
Increase required			1,447,382.76
Percent increase			66%
Estimated monthly rate for 5,000 gallons			56.80
Present Worth Analysis			
Present Worth Construction Costs			4,560,000.00
Presnet Worth Operation Costs (pwf =	10.29		37,426,847.30
Total Present Worth			41,986,847.30

Alternative 3-A – Screening North CSO Basin

Sensitive Areas – Flooding of sensitive areas by Cypress Creek would remain a continuous problem.

Treatment – The North CSO would be equipped with screening to control floatables. Both North and South Basins would continue to provide primary clarification. No disinfection would be provided.

Wasteload to Cypress Creek - An average of 280 Million Gallons per year (MG/yr.) of primary treated overflow will be discharged into Cypress Creek. Unscreened volume remaining will be 124 Million Gallons per year. Undisinfected volume remaining will be 280 Million Gallons per year.

This alternative would not satisfy the presumptive parameters.

Estimated Construction Cost	$500,000.00
Estimated Non-Construction Cost	$100,000.00
Total Project Cost	**$600,000.00**

		Alternate 3-A Screening North CSO Construction Costs	Operation Costs
Base Line CSO Volume Estimates after new plant			
CSO Volume	280 MG/yr		
CSO Volume screened	0 MG/yr		
CSO Volume disinfected	0 MG/yr		
North CSO Basin			
Complete Separation			
Disnifection and screening			
Screening only		600,000.00	
CSO Volume	156 MG/yr		
CSO Volume screened	156 MG/yr		
CSO Volume disinfected	0 MG/yr		
South CSO Basin			
Complete Separation			
Disnifection and screening			
Screening only		-	
CSO Volume	124 MG/yr		
CSO Volume screened	0 MG/yr		
CSO Volume disinfected	0 MG/yr		
Total Project Costs		$ 600,000.00	
Total Volume Estimates after CSO improvements			
CSO Volume remaining	280 MG/yr		
CSO Volume screened	156 MG/yr		
CSO Volume disinfected	0 MG/yr		
Total Treatment Cost Estimate			
Year 2003 Annual Revenue Requirements per H.J Humbaugh Report			2,189,823.00
Screening maintnance cost	156 MG/yr		156,000.00
$ 1.00 /1000 gal			
Disinfection Treatment Cost	0 MG/yr		-
$ 2.00 /1000 gal			
MS4 annual cost			150,000.00
Debt service LTCP 5% Bond Issue CRF =	0.08024259		48,145.55
Debt service reserve (at 25%)			12,036.39
Total Estimated Annual Revenue Requirements			2,556,004.94
Less Current Revenue			(2,189,823.00)
Increase required			366,181.94
Percent Increase			17%
Estimated monthly rate for 5,000 gallons			39.92
Present Worth Analysis			
Present Worth Construction Costs			600,000.00
Presnet Worth Operation Costs (pwf =	10.29		26,301,290.86
Total Present Worth			26,901,290.86

Alternative 3-B – Screening South CSO Basin

Sensitive Areas – Flooding of sensitive areas by Cypress Creek would remain a continuous problem.

Treatment – The South CSO would be equipped with screening to control floatables. Both North and South Basins would continue to provide primary clarification. No disinfection would be provided.

Wasteload to Cypress Creek - An average of 280 Million Gallons per year (MG/yr.) of primary treated overflow will be discharged into Cypress Creek. Unscreened volume remaining will be 156 Million Gallons per year. Undisinfected volume remaining will be 280 Million Gallons per year.

This alternative would not satisfy the presumptive parameters.

Estimated Construction Cost	$500,000.00
Estimated Non-Construction Cost	$100,000.00
Total Project Cost	**$600,000.00**

		Alternate 3-B Screening North CSO	
		Construction Costs	Operation Costs
Base Line CSO Volume Estimates after new plant			
CSO Volume	280 MG/yr		
CSO Volume screened	0 MG/yr		
CSO Volume disinfected	0 MG/yr		
North CSO Basin			
Complete Separation			
Disnifection and screening			
Screening only		-	
CSO Volume	156 MG/yr		
CSO Volume screened	0 MG/yr		
CSO Volume disinfected	0 MG/yr		
South CSO Basin			
Complete Separation			
Disnifection and screening			
Screening only		600,000.00	
CSO Volume	124 MG/yr		
CSO Volume screened	124 MG/yr		
CSO Volume disinfected	0 MG/yr		
Total Project Costs		$ 600,000.00	
Total Volume Estimates after CSO improvements			
CSO Volume remaining	280 MG/yr		
CSO Volume screened	124 MG/yr		
CSO Volume disinfected	0 MG/yr		
Total Treatment Cost Estimate			
Year 2003 Annual Revenue Requirements per H.J Humbaugh Report			2,189,823.00
Screening maintneance cost	124 MG/yr		124,000.00
$ 1.00 /1000 gal			
Disinfection Treatment Cost	0 MG/yr		-
$ 2.00 /1000 gal			
MS4 annual cost			150,000.00
Debt service LTCP 5% Bond issue CRF =	0.08024259		48,145.55
Debt service reserve (at 25%)			12,036.39
Total Estimated Annual Revenue Requirements			2,524,004.94
Less Current Revenue			(2,189,823.00)
Increase required			334,181.94
Percent Increase			15%
Estimated monthly rate for 5,000 gallons			39.42
Present Worth Analysis			
Present Worth Construction Costs			600,000.00
Presnet Worth Operation Costs (pwf =	10.29		25,972,010.86
Total Present Worth			26,572,010.86

Alternative 3-C – Screening Both CSO Basins

Sensitive Areas – Flooding of sensitive areas by Cypress Creek would remain a continuous problem.

Treatment – Both Northand South CSO's would be equipped with screening to control floatables. Both North and South Basins would continue to provide primary clarification. No disinfection would be provided.

Wasteload to Cypress Creek - An average of 280 Million Gallons per year (MG/yr.) of primary treated overflow will be discharged into Cypress Creek. Unscreened volume remaining will be 0 Million Gallons per year. Undisinfected volume remaining will be 280 Million Gallons per year.

This alternative would not satisfy the presumptive parameters.

Estimated Construction Cost	$1,000,000.00
Estimated Non-Construction Cost	$200,000.00
Total Project Cost	**$1,200,000.00**

		Alternate 3-C Screening North and South CSO Construction Costs	Operation Costs
Base Line CSO Volume Estimates after new plant			
CSO Volume	280 MG/yr		
CSO Volume screened	0 MG/yr		
CSO Volume disinfected	0 MG/yr		
North CSO Basin			
Complete Separation			
Disnifection and screening			
Screening only		600,000.00	
CSO Volume	156 MG/yr		
CSO Volume screened	124 MG/yr		
CSO Volume disinfected	0 MG/yr		
South CSO Basin			
Complete Separation			
Disnifection and screening			
Screening only		600,000.00	
CSO Volume	124 MG/yr		
CSO Volume screened	124 MG/yr		
CSO Volume disinfected	0 MG/yr		
Total Project Costs		$ 1,200,000.00	
Total Volume Estimates after CSO improvements			
CSO Volume remaining	280 MG/yr		
CSO Volume screened	248 MG/yr		
CSO Volume disinfected	0 MG/yr		
Total Treatment Cost Estimate			
Year 2003 Annual Revenue Requirements per H.J Humbaugh Report			2,189,823.00
Screening maintneance cost	248 MG/yr		248,000.00
$ 1.00 /1000 gal			
Disinfection Treatment Cost	0 MG/yr		-
$ 2.00 /1000 gal			
MS4 annual cost			150,000.00
Debt service LTCP 5% Bond issue CRF =	0.08024259		96,291.11
Debt service reserve (at 25%)			24,072.78
Total Estimated Annual Revenue Requirements			2,708,186.89
Less Current Revenue			(2,189,823.00)
Increase required			518,363.89
Percent increase			24%
Estimated monthly rate for 5,000 gallons			42.30
Present Worth Analysis			
Present Worth Construction Costs			1,200,000.00
Presnet Worth Operation Costs (pwf =	10.29		27,867,243.05
Total Present Worth			29,067,243.05

Section 5 - Maximize Flow Through POTW

5-A Alternatives for Maximizing Flow through POTW

The City of Boonville recently completed construction of a new WWTP. This plant is designed to transport up to 9 MGD peak rate and treat to secondary standards. This rate was established as the peak capacity of the existing 24-inch interceptor sewer, thus maximizing flow capacity to the plant.

Reviewing the MRO's for the plant and the CSO for 2004 and 2005, revealed that the full peak capacity of the plant is not being utilized. As shown in the system map included in Section 3, the system dry weather flows converge at the Main Lift Station. During wet weather, excess flow is diverted to the North CSO by overflowing diversion dam. The dam is set at the crown of the 15 inch dry weather gravity sewer. Likewise during dry weather, excess flow is diverted to the South CSO by a similar diversion dam. The City of Boonville will increase the diversion flow rate, during moderate storms, by increasing the height of each diversion dam. A temporary plywood and sandbag wier will be constructed at each diversion dam to raise the dam elevation 6 to 12 inches. The impact will be monitored and if acceptable a permanent dam will be constructed.

The selected plan will also include modification to the basin return pumping. These modifications will include

1. Operating return pumps during storm events rather than waiting for storm to subside. This will increase flow to plant by 0.5 MGD each or 1.0 MGD total.
2. Construct 6" force main to allow basin transfer pumps to also be used for basin return. This could increase flow to plant an additional 1.0 MGD (see plan sheets which follow).
3. Upsize force main from North CSO to plant force main from 4 inch to 10 inch to allow higher return rates (see plans sheets which follow).
4. Construct 10 inch force main from South CSO to Long John Silvers Lift Station. This will remove pond return from the gravity sewers and deliver it directly to the Main Lift Station (see plans sheets which follow).

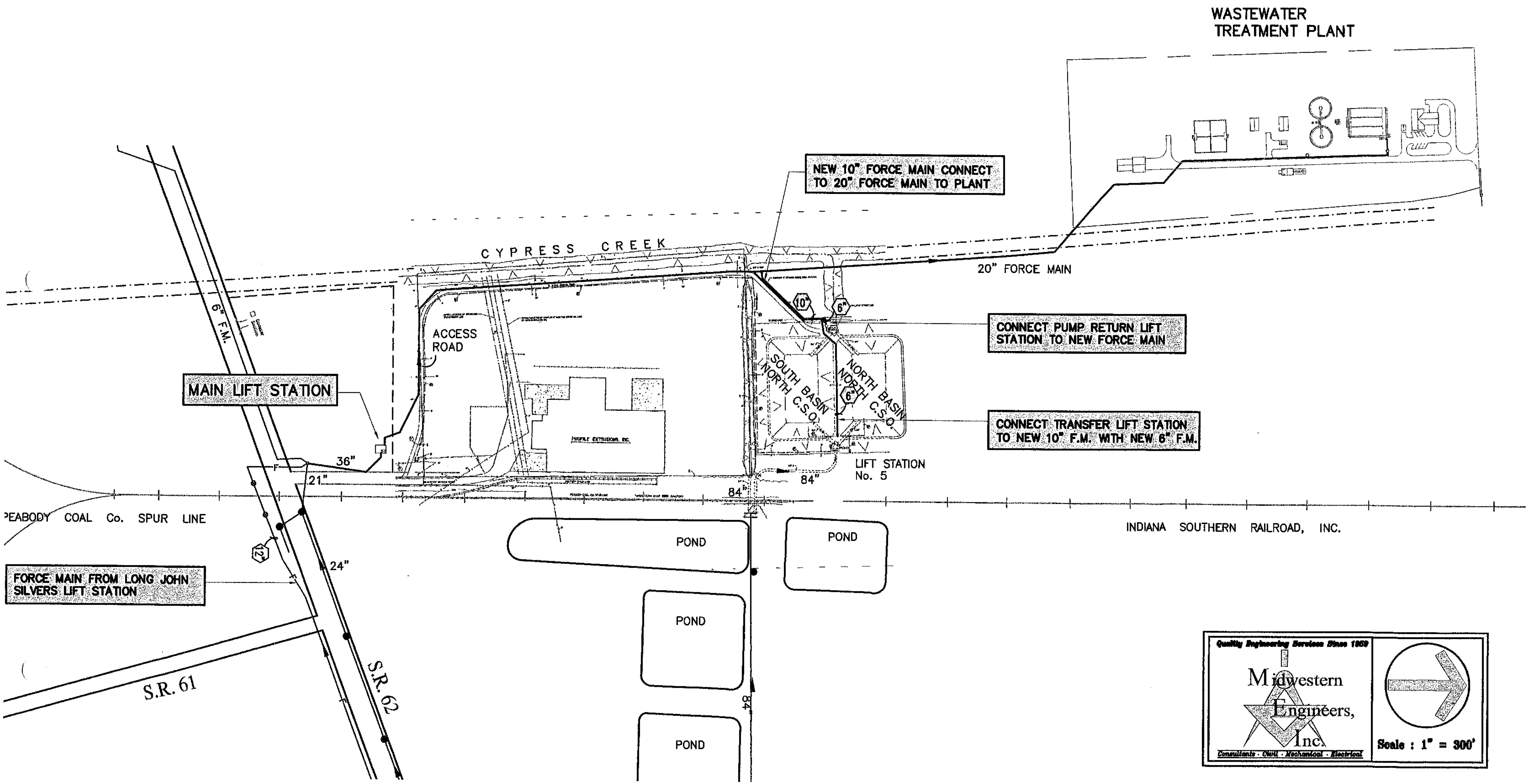
Growth Effects

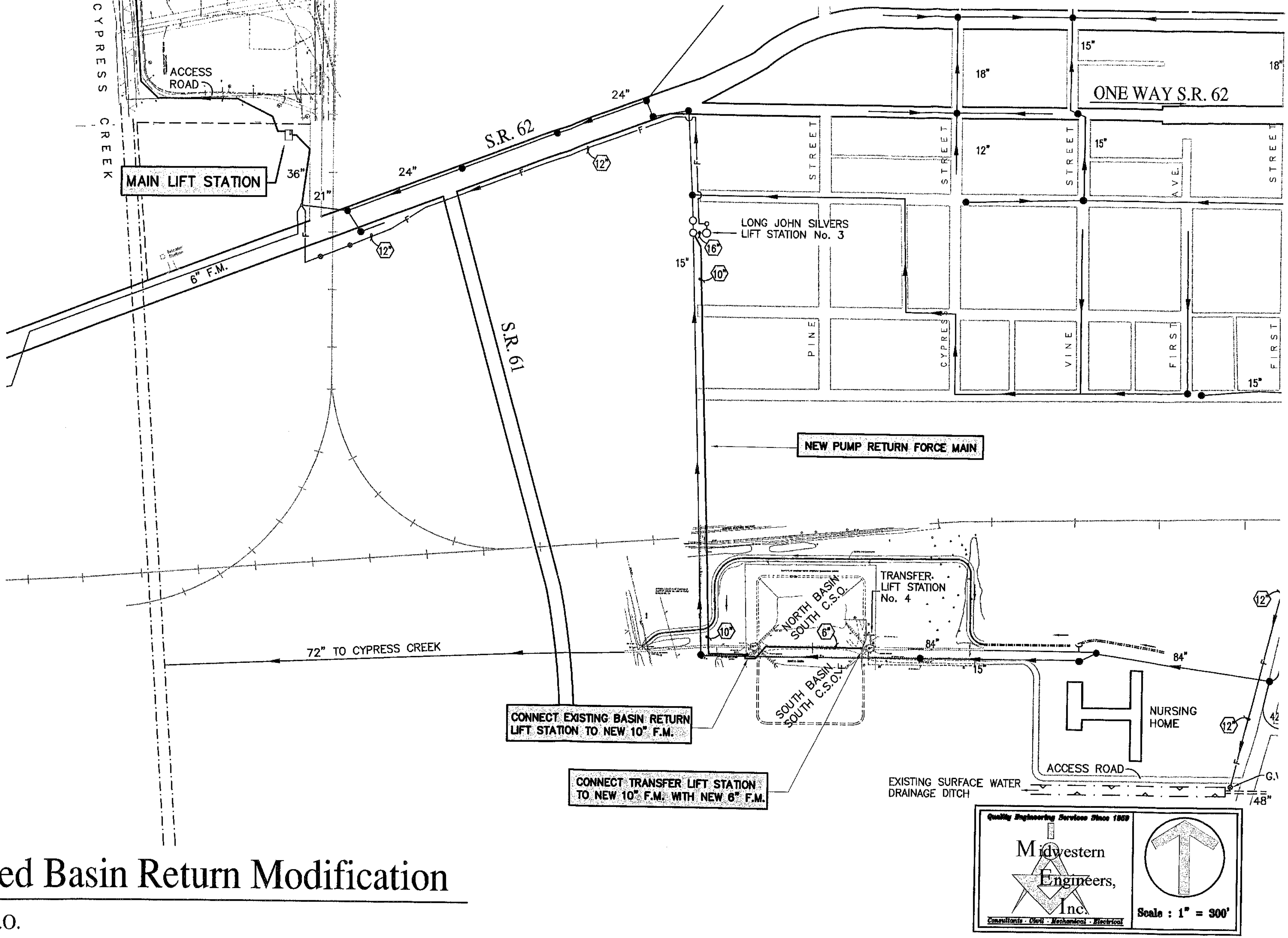
In considering methods to maximize flow to the POTW it is imperative that the impact of future growth be considered. In design of Boonville's new plant the effects of growth were evaluated in detail. These were discussed in the 1999 Facility Plan. Large areas of future growth were identified and growth potential was estimated to be

Western	452 Residential Units	25 Commercial	200 Industrial
Northern	705 Residential Units	3 Commercial	0 Industrial
Southern	78 Residential Units	1 Commercial	0 Industrial
Eastern	175 Residential Units	25 Commercial	0 Industrial
Total	1,410 Residential Units	54 Commercial	200 Industrial

Proposed Basin Return Modification

NORTH C.S.O.





Proposed Basin Return Modification

SOUTH C.S.O.

Long term Boonville could expect total residential growth of 4,800 lots from undeveloped property.

The design of the POTW was based upon the identified growth and 50% of the potential from undeveloped property or a population of 13,499.

The design basis of the plant was

Design Dry Weather

Total DCI		
	Current	550,000 GPD
	Future	553,000 GPD
	Ave. Inf.	600,000 GPD
Ave Dry Weather		1,703,000 GPD

Design Wet Weather

Total DCI		
	Current	550,000 GPD
	Future	553,000 GPD
	Ave. I/I	1,260,000 GPD
	CSO Return	500,000 GPD
Total Ave. Flow		2,863,000 GPD
Actual 2005 Ave.		1.4 MGD

Design Peak Hourly Flow Rate

DCI = 3 x 1.03 MGD	=	3.1 MGD
I/I Ave.	=	1.4 MGD
CSO Return	=	0.5 MGD
Peak Hourly		5.0 MGD
Storm instantaneous	=	9 MGD

The largest potential growth is the Western area which will be served by the Main Lift Station and not the Combined Sewer System. This growth will not increase overflows.

The second largest potential growth is the Northern area. Discussions are underway with the County regarding developing a sewer for a portion of this Northern area. Boonville is requiring all sewage from this area to be conveyed around the Combined Sewers directly to the plant. The Northern growth will not increase overflows.

Currently there are no plans to sewer any of the Eastern or Southern growth areas. The service to theses areas will likewise be directed around the Combined Sewers.

5-B Diversion of Flows around Secondary Treatment

The new City of Boonville WWTP has the capacity to shut off mixing in the last portion of the aeration basin when necessary to maximize high flow operation. This eliminates the need to divert flows around secondary treatment.

Section 5 - Maximize Flow Through POTW

5-A Alternatives for Maximizing Flow through POTW

The City of Boonville recently completed construction of a new WWTP. This plant is designed to transport up to 9 MGD peak rate and treat to secondary standards. This rate was established as the peak capacity of the existing 24-inch interceptor sewer, thus maximizing flow capacity to the plant.

5-B Diversion of Flows around Secondary Treatment

The new City of Boonville WWTP has the capacity to shut off mixing in the last portion of the aeration basin when necessary to maximize high flow operation. This eliminates the need to divert flows around secondary treatment.

Replaced

2-22-06

Section 6 - Minimization of Industrial Discharges During Wet Weather

Listed below are three companies operating within the Boonville City Limits that could be considered small industries. Only one of the three, Lincoln Industries, discharges any type of product water. Lincoln Industries is a company that produces plastic parts and moldings. Annually, this company monitors and sends the City a report of product water analysis. There is no pretreatment program in place for any of below mentioned companies. Flow is not substantial in terms of sewer system impact. Practically all discharge is of a domestic nature coming from restrooms. The City does not have a program for minimization of Industrial Discharge during wet weather at this time.

Lincoln Industries: 110 West Division St.
Plastic Parts and Moldings

Profile Extrusions: Essex Drive
Recycling of aluminum cans to aluminum bars for re-use

Prime Food, Inc.: 107 E. Walnut St.
Egg washing and shipping

Section 7 - Cost vs. Performance considerations for screening and ranking of control alternatives

In screening and ranking control alternatives, various tests are considered. The first test is to rank all alternatives into treatment groups as shown in Tables 7-1, 7-2, and 7-3.

Table 7-1
Ranking of Alternatives by Volume CSO Remaining

	CSO Volume Remaining MG/Yr	Present Worth $ Millions
Meets Presumptive Criteria		
Alternative 1-C	0	154.50
Alternative 2-C	136	38.10
Meets Solids Floatables Control		
Alternative 3-C	136	28.5
Non Compliant Alternatives		
Alternative 1-B	66	101.5
Alternative 1-A	70	78.3
Alternative 2-A	136	31.5
Alternative 2-B	136	31.3
Alternative 3-A	136	26.6
Alternative 3-B	136	26.6

Table 7-2
Ranking of Alternatives by Volume Unscreened CSO Remaining

	Unscreened CSO Volume Remaining MG/Yr	Present Worth $ Millions
Meets Presumptive Criteria		
Alternative 1-C	0	154.50
Alternative 2-C	0	38.10
Meets Solids Floatables Control		
Alternative 3-C	0	28.5
Non Compliant Alternatives		
Alternative 1-B	66	101.5
Alternative 2-A	66	31.5
Alternative 3-A	66	26.6
Alternative 1-A	70	78.3
Alternative 2-B	70	31.3
Alternative 3-B	70	26.6

Table 7-3
Ranking of Alternatives by Volume non-disinfected CSO Remaining

	Non-disinfected CSO Volume Remaining MG/Yr	Present Worth $ Millions
Meets Presumptive Criteria		
Alternative 1-C	0	154.50
Alternative 2-C	0	38.10
Meets Solids Floatables Control		
Alternative 3-C	136	28.5
Non Compliant Alternatives		
Alternative 1-B	66	101.5
Alternative 2-A	66	31.5
Alternative 1-A	70	78.3
Alternative 2-B	70	31.3
Alternative 3-A	136	26.6
Alternative 3-B	136	26.6

Section 7 - Cost vs. Performance considerations for screening and ranking of control alternatives

In screening and ranking control alternatives, various tests are considered. The first test is to rank all alternatives into treatment groups as shown in Tables 7-1, 7-2, and 7-3.

Replaced
2-28-06

Table 7-1
Ranking of Alternatives by Volume CSO Remaining

	CSO Volume Remaining MG/Yr	Present Worth $ Millions
Meets Presumptive Criteria		
Alternative 1-C	0	154.50
Alternative 2-C	280	42.00
Meets Solids Floatables Control		
Alternative 3-C	280	29.1
Non Compliant Alternatives		
Alternative 1-B	124	100.9
Alternative 1-A	156	77.7
Alternative 2-A	280	33.5
Alternative 2-B	280	32.5
Alternative 3-A	280	26.9
Alternative 3-B	280	26.6

Table 7-2
Ranking of Alternatives by Volume Unscreened CSO Remaining

	Unscreened CSO Volume Remaining MG/Yr	Present Worth $ Millions
Meets Presumptive Criteria		
Alternative 1-C	0	154.50
Alternative 2-C	0	42.00
Meets Solids Floatables Control		
Alternative 3-C	0	29.1
Non Compliant Alternatives		
Alternative 1-B	124	100.9
Alternative 2-A	124	33.5
Alternative 3-A	124	26.9
Alternative 1-A	156	77.7
Alternative 2-B	156	32.5
Alternative 3-B	156	26.6

Table 7-3
Ranking of Alternatives by Volume non-disinfected CSO Remaining

	Non-disinfected CSO Volume Remaining MG/Yr	Present Worth $ Millions
Meets Presumptive Criteria		
Alternative 1-C	0	154.50
Alternative 2-C	0	42.00
Meets Solids Floatables Control		
Alternative 3-C	280	29.1
Non Compliant Alternatives		
Alternative 1-B	124	100.9
Alternative 2-A	124	33.5
Alternative 1-A	156	77.7
Alternative 2-B	156	32.5
Alternative 3-A	280	26.9
Alternative 3-B	280	26.6

In establishing the cost performance curve the performance of each alternative in each group is first recast to include the situation prior to the new plant. The results of this recasting are presented in Tables 8-1, 8-2 and 8-3.

In theory, when this data is plotted, a curve can be fit through the points which represents a cost/ performance curve for Boonville's CSO LTCP. These points plot as a cloud not as a line in Figure 8-2 and 8-3. Figure 8-1 shows a fairly clear trend. Two lines can be constructed to represent the cost performance curve. The intersection of these lines approximates the knee of the curve. The data for MG/yr. of overflow remaining presents the best fit. Figure 8-1 will be used for determining the "knee of the curve."

The knee occurs in the vicinity of 136 MG of overflow remaining and present worth of $28 million. Data points in vicinity of the knee are 3-A, 3-B, and 3-C. None of which comply with disinfection requirement. Alternative 2-C is the alternative nearest the "Knee" which would meet the presumptive criteria. Alternate 2-C has a present worth of $38 million.

A horizontal dashed line has been added to Figure 8-10 to mark the present worth of 2% of the year 2000 median income calculated as follows:

= 2% x (10.29crf) x $34,913 (year) x (2,910 households) = $20,908,000.00

All Alternatives near knee have a cost greater than 2% of the median income.

8-B Reduction of CSO's Beyond the "Knee Of The Curve"

In Section 9 the City's financial capability is reviewed. This section indicates that the City of Boonville will incur significant financial hardship trying to meet the "knee" of the curve. It will be difficult for the City to implement any controls past the "knee".

Section 8 - Development of a Cost/Performance Curve

8-A Establishing the "Knee of the Curve" Point on Cost/Performance Curve

In evaluating the "Knee of the Curve" Point for Boonville it is necessary to evaluate the cost performance of the alternatives individually and also as a whole. To determine the cost/performance the estimated present worth cost for each alternative was determined, based upon present worth factor 10.29. The components used in determining the present worth are:

1. Current revenue requirements
   (Includes operation costs of the WWTP Collection System and existing CSO are included in the current revenue requirements).
2. Estimated construction costs for various improvements
   (Financing of capital costs was considered to be sale of Revenue Bonds. Costs are estimated in each Alternative for both debt service and reserve requirements. No revenues due to user growth were considered. Such growth is possible, but is not fixed, known, or measurable. Tax revenues were not considered a viable source of funding).
3. Estimated additional operation costs for various improvements
   (Operating cost of new screening or disinfection systems are projected for each alternative based upon expected gallons to be treated).
4. Estimated additional operation costs for CSO demonstration

In Section 4 the various costs and the present worth calculation for each alternative are presented in detail

Boonville has currently expended over $10 million dollars to expand its WWTP and has greatly reduced overflow volume. To account for this expense a base cost performance point was determined to be as follows.

PRESENT WORTH CURRENT SITUATION

Year 2003 annual revenue required	= $2,189,823.00
x (p.w.f. = 10.29)	= $22.5 Million
Less cost of plant expansion	= ($10.0 Million)
Present worth situation prior to new plant	$12.5 Million
Volume CSO prior to new plant	497 MG/Yr
Volume Unscreened	497 MG/Yr
Volume Undisinfected	497 MG/Yr

Table 8-1
Cost performance by Volume CSO Remaining

	CSO Volume Remaining MG/Yr	Present Worth $ Millions
Meets Presumptive Criteria		
Alternative 1-C	0	154.50
Alternative 2-C	136	38.10
Meets Solids Floatables Control		
Alternative 3-C	136	28.5
Non Compliant Alternatives		
Alternative 1-B	66	101.5
Alternative 1-A	70	78.3
Alternative 2-A	136	31.5
Alternative 2-B	136	31.3
Alternative 3-A	136	26.6
Alternative 3-B	136	26.6
Prior to New Plant	497	12.5

Table 8-2
Cost Performance by Volume Unscreened CSO Remaining

	Unscreened CSO Volume Remaining MG/Yr	Present Worth $ Millions
Meets Presumptive Criteria		
Alternative 1-C	0	154.50
Alternative 2-C	0	38.10
Meets Solids Floatables Control		
Alternative 3-C	0	28.5
Non Compliant Alternatives		
Alternative 1-B	66	101.5
Alternative 1-A	70	78.3
Alternative 2-A	66	31.5
Alternative 2-B	70	31.3
Alternative 3-A	66	26.6
Alternative 3-B	70	26.6
Prior to New Plant	497	12.5

Table 8-3
Cost Performance by Volume Non-disinfected CSO Remaining

	Non-disinfected CSO Volume Remaining MG/Yr	Present Worth $ Millions
Meets Presumptive Criteria		
Alternative 1-C	0	154.50
Alternative 2-C	0	38.10
Meets Solids Floatables Control		
Alternative 3-C	136	28.5
Non Compliant Alternatives		
Alternative 1-B	66	101.5
Alternative 1-A	70	78.3
Alternative 2-A	66	31.5
Alternative 2-B	70	31.3
Alternative 3-A	136	26.6
Alternative 3-B	136	26.6
Prior to New Plant	497	12.5

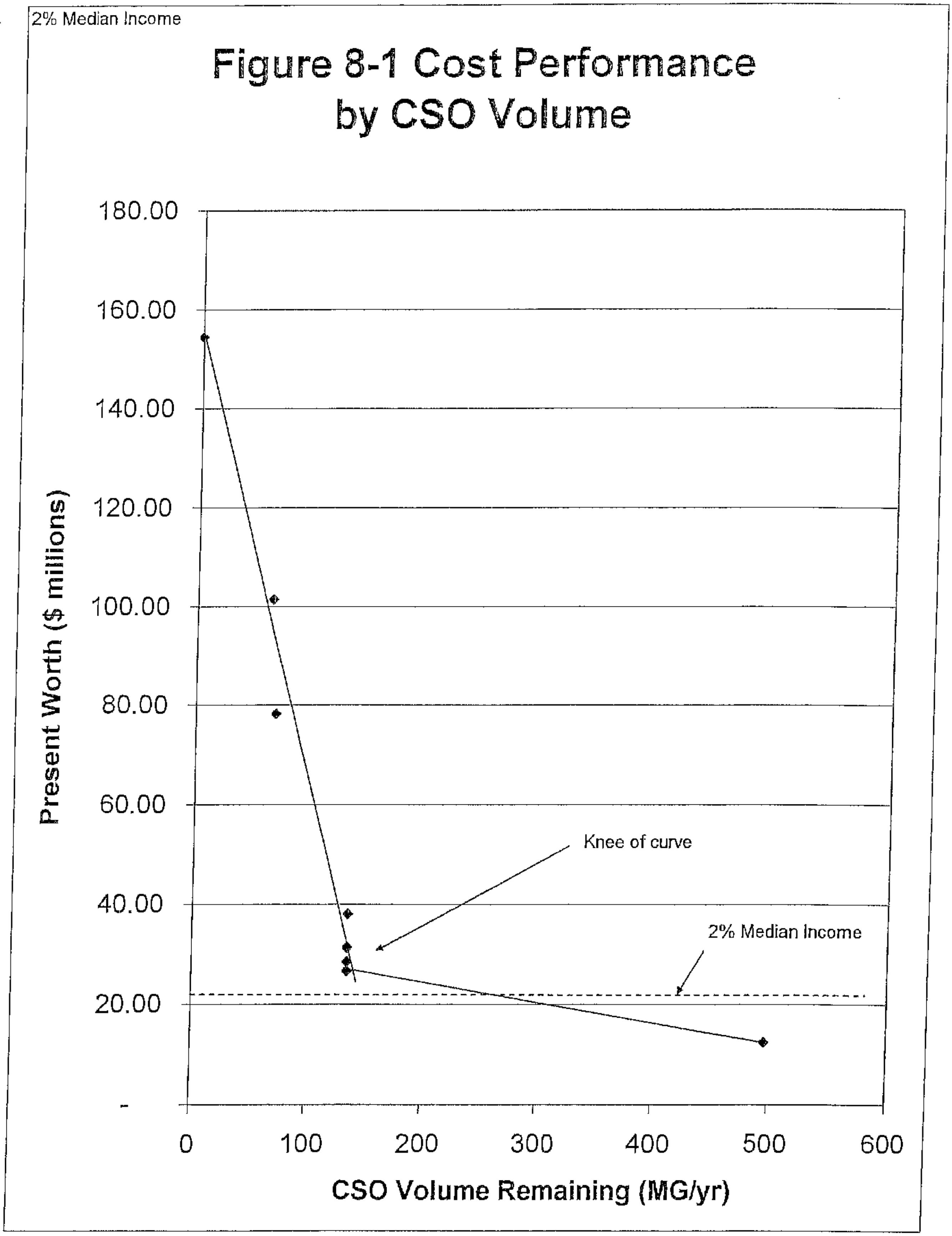
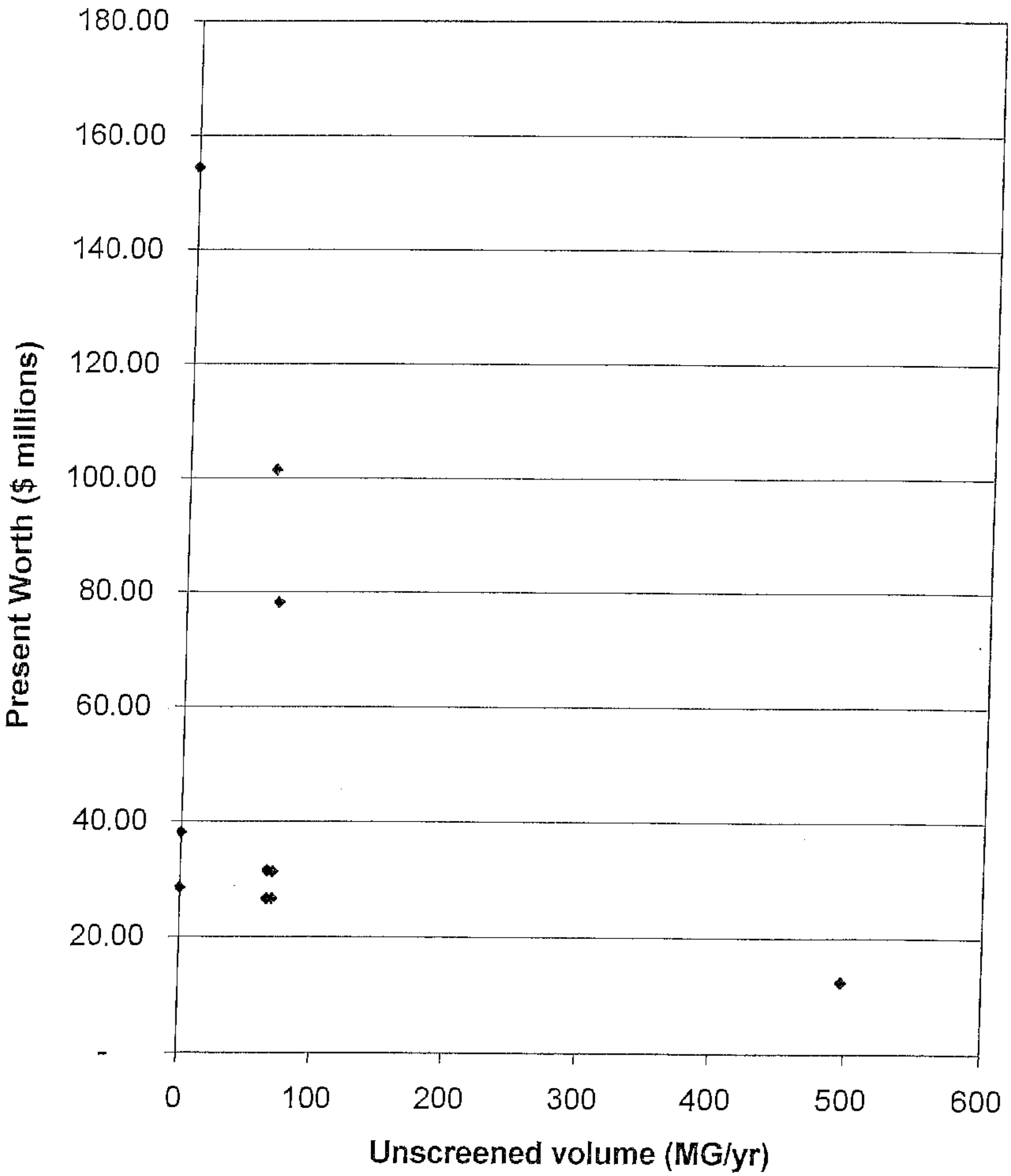

2% Median Income
Figure 8-1 Cost Performance
by CSO Volume
180.00
160.00
140.00
120.00
100.00
80.00
60.00
40.00
20.00
-
Present Worth ($ millions)
Knee of curve
2% Median Income
0
100
200
300
400
500
600
CSO Volume Remaining (MG/yr)

Figure 8-2 Cost Performance by Screening



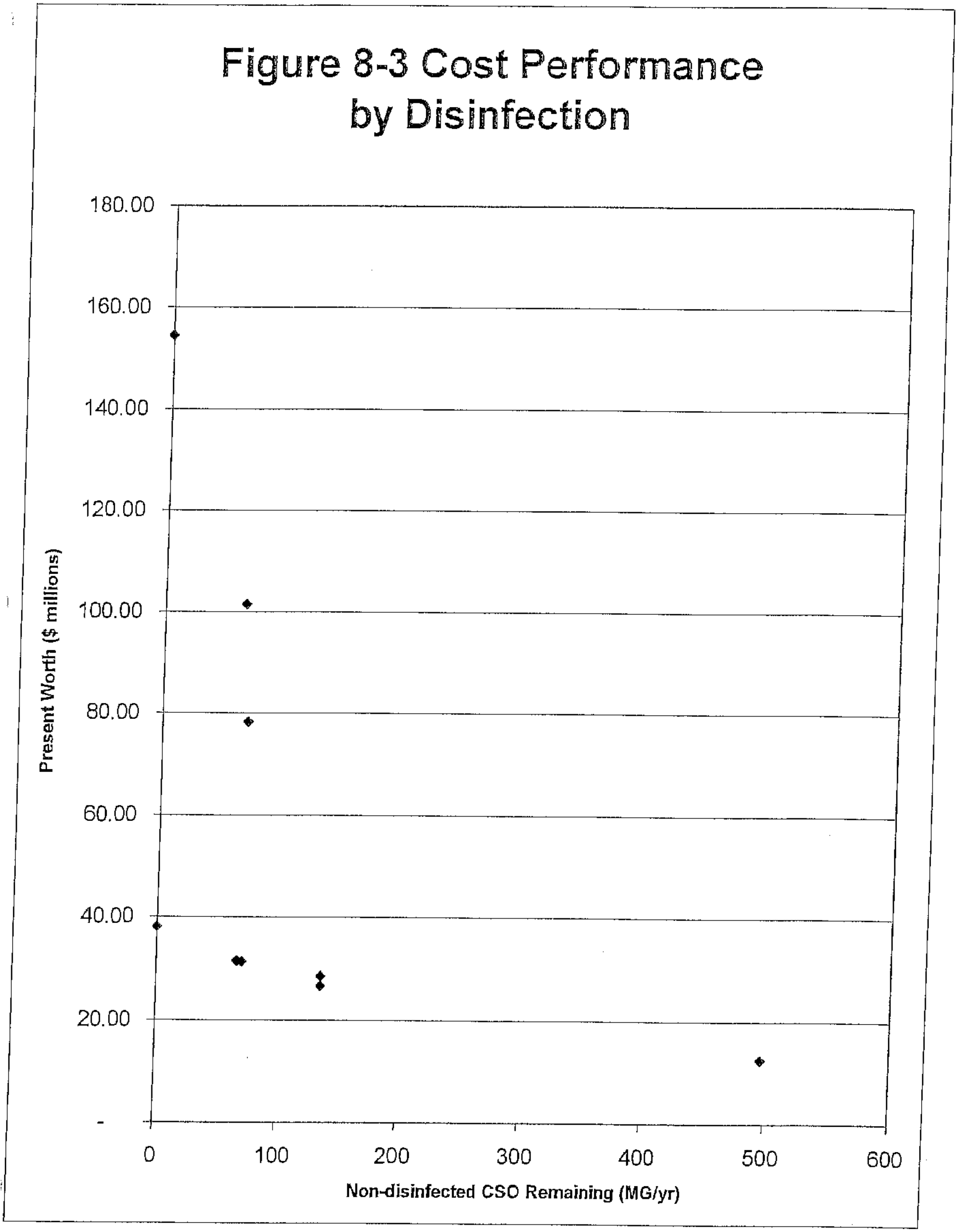


Figure 8-3 Cost Performance by Disinfection
180.00
160.00
140.00
120.00
100.00
80.00
60.00
40.00
20.00
-
0
100
200
300
400
500
600
Present Worth ($ millions)
Non-disinfected CSO Remaining (MG/yr)

Section 8 - Development of a Cost/Performance Curve

8-A Establishing the "Knee of the Curve" Point on Cost/Performance Curve

In evaluating the "Knee of the Curve" Point for Boonville it is necessary to evaluate the cost performance of the alternatives individually and also as a whole. To determine the cost/performance the estimated present worth cost for each alternative was determined, based upon present worth factor 10.29. The components used in determining the present worth are:

Current revenue requirements
Estimated construction costs for various improvements
Estimated additional operation costs for various improvements
Estimated additional operation costs for a projected MS4 program

The present worth calculation for each alternative were presented in Section 4

Boonville has currently expended over $10 million dollars to expand its WWTP and has greatly reduced overflow volume. To account for this expense a base cost performance point was determined to be as follows.

PRESENT WORTH CURRENT SITUATION

Year 2003 annual revenue required	= $2,189,823.00
x (p.w.f. = 10.29)	= $22.5 Million
Less cost of plant expansion	= $10.0 Million
Present worth situation prior to new plant	$12.5 Million
Volume CSO prior to new plant	497 MG/Yr
Volume Unscreened	497 MG/Yr
Volume Undisinfected	497 MG/Yr

In establishing the cost performance curve the performance of each alternative in each group is first recast to include the situation prior to the new plant. The results of this recasting are presented in Tables 8-1, 8-2 and 8-3.

In theory, when this data is plotted, a curve can be fit through the points which represents a cost/ performance curve for Boonville's CSO LTCP. These points plot as a cloud not as a line in Figure 8-2 and 8-3. Figure 8-1 shows a fairly clear trend. Two lines can be constructed to represent the cost performance curve. The intersection of these lines approximates the knee of the curve. The data for MG/yr. of overflow remaining presents the best fit. Figure 8-1 will be used for determining the "knee of the curve."

The knee occurs in the vicinity of 280 MG of overflow removed and present worth of $29 million. Data point in vicinity of the knee is 3-C. A horizontal dashed line had been added to mark the present worth of 2% of the year 2000 median income calculated as follows:

= 2% x (10.29crf) x $34,913 (year) x (2,910 households) = $20,908,000.00

8-B Reduction of CSO's Beyond the "Knee Of The Curve"

In Section 9 the City's financial capability is reviewed. This section indicates that the City of Boonville will incur significant financial hardship trying to meet the "knee" of the curve. It will be difficult for the City to implement any controls past the "knee".

Table 8-1
Cost performance by Volume CSO Remaining

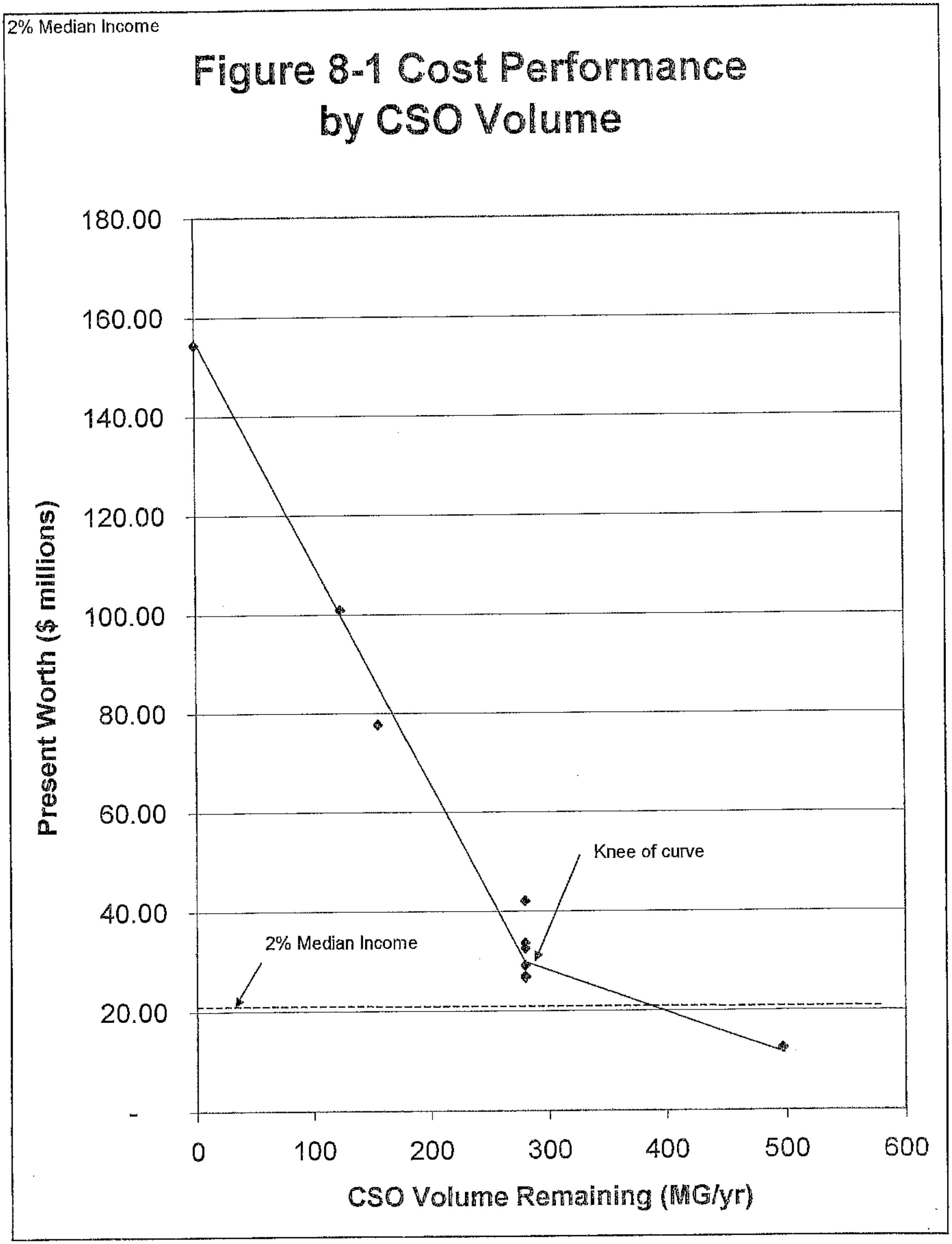
	CSO Volume Remaining MG/Yr	Present Worth $ Millions
Meets Presumptive Criteria		
Alternative 1-C	0	154.50
Alternative 2-C	280	42.00
Meets Solids Floatables Control		
Alternative 3-C	280	29.1
Non Compliant Alternatives		
Alternative 1-B	124	100.9
Alternative 1-A	156	77.7
Alternative 2-A	280	33.5
Alternative 2-B	280	32.5
Alternative 3-A	280	26.9
Alternative 3-B	280	26.6
Prior to New Plant	497	12.5

Table 8-2
Cost Performance by Volume Unscreened CSO Remaining

	Unscreened CSO Volume Remaining MG/Yr	Present Worth $ Millions
Meets Presumptive Criteria		
Alternative 1-C	0	154.50
Alternative 2-C	0	42.00
Meets Solids Floatables Control		
Alternative 3-C	0	29.1
Non Compliant Alternatives		
Alternative 1-B	124	100.9
Alternative 2-A	124	33.5
Alternative 3-A	124	26.9
Alternative 1-A	156	77.7
Alternative 2-B	156	32.5
Alternative 3-B	156	26.6
Prior to New Plant	497	12.5

Table 8-3
Cost Performance by Volume Non-disinfected CSO Remaining

	Non-disinfected CSO Volume Remaining MG/Yr	Present Worth $ Millions
Meets Presumptive Criteria		
Alternative 1-C	0	154.50
Alternative 2-C	0	42.00
Meets Solids Floatables Control		
Alternative 3-C	280	29.1
Non Compliant Alternatives		
Alternative 1-B	124	100.9
Alternative 2-A	124	33.5
Alternative 1-A	156	77.7
Alternative 2-B	156	32.5
Alternative 3-A	280	26.9
Alternative 3-B	280	26.6
Prior to New Plant	497	12.5


2% Median Income
Figure 8-1 Cost Performance
by CSO Volume
180.00
160.00
140.00
120.00
100.00
80.00
60.00
40.00
20.00
-
Present Worth ($ millions)
0
100
200
300
400
500
600
CSO Volume Remaining (MG/yr)
Knee of curve
2% Median Income

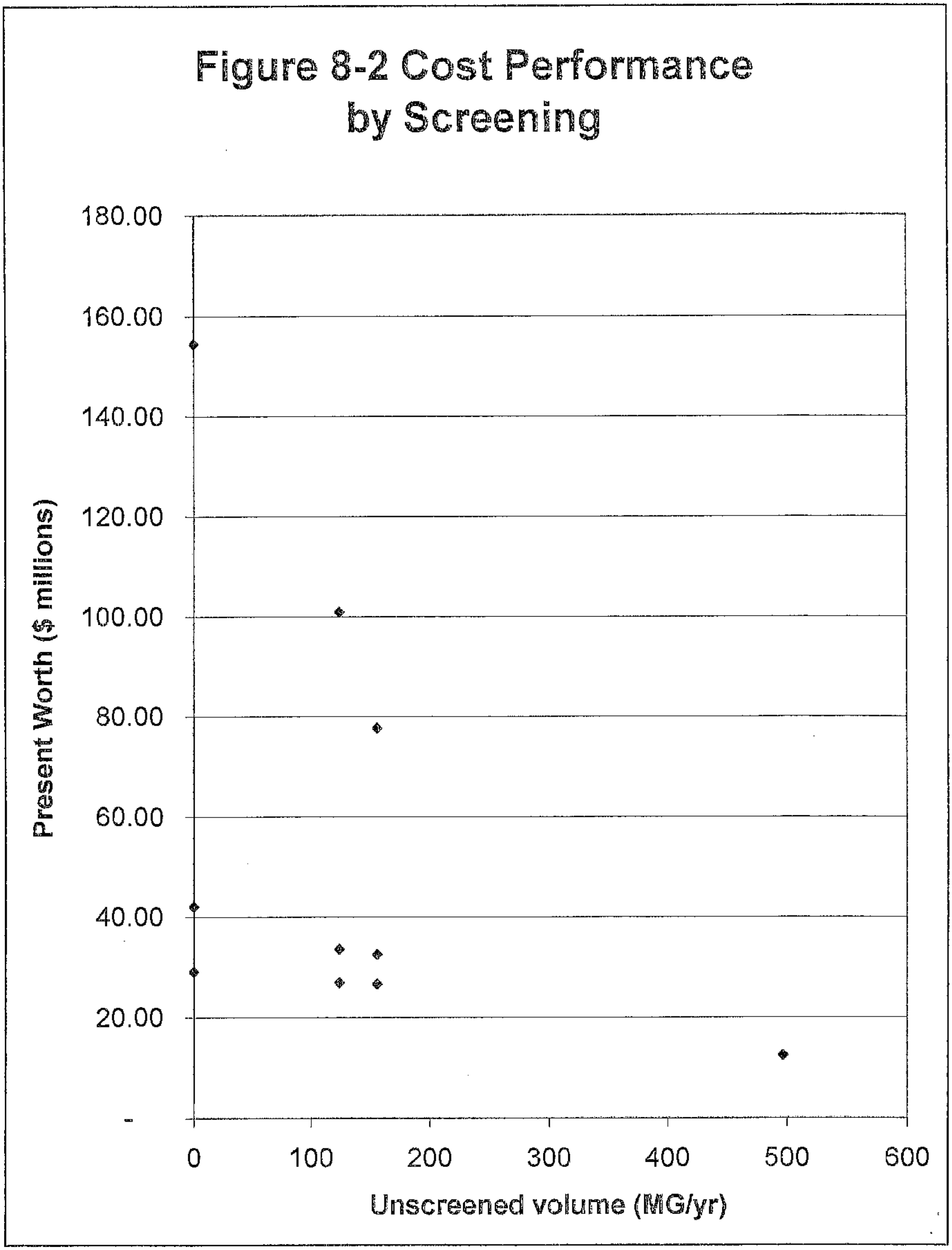


Figure 8-2 Cost Performance
by Screening
180.00
160.00
140.00
120.00
100.00
80.00
60.00
40.00
20.00
-
0
100
200
300
400
500
600
Present Worth ($ millions)
Unscreened volume (MG/yr)

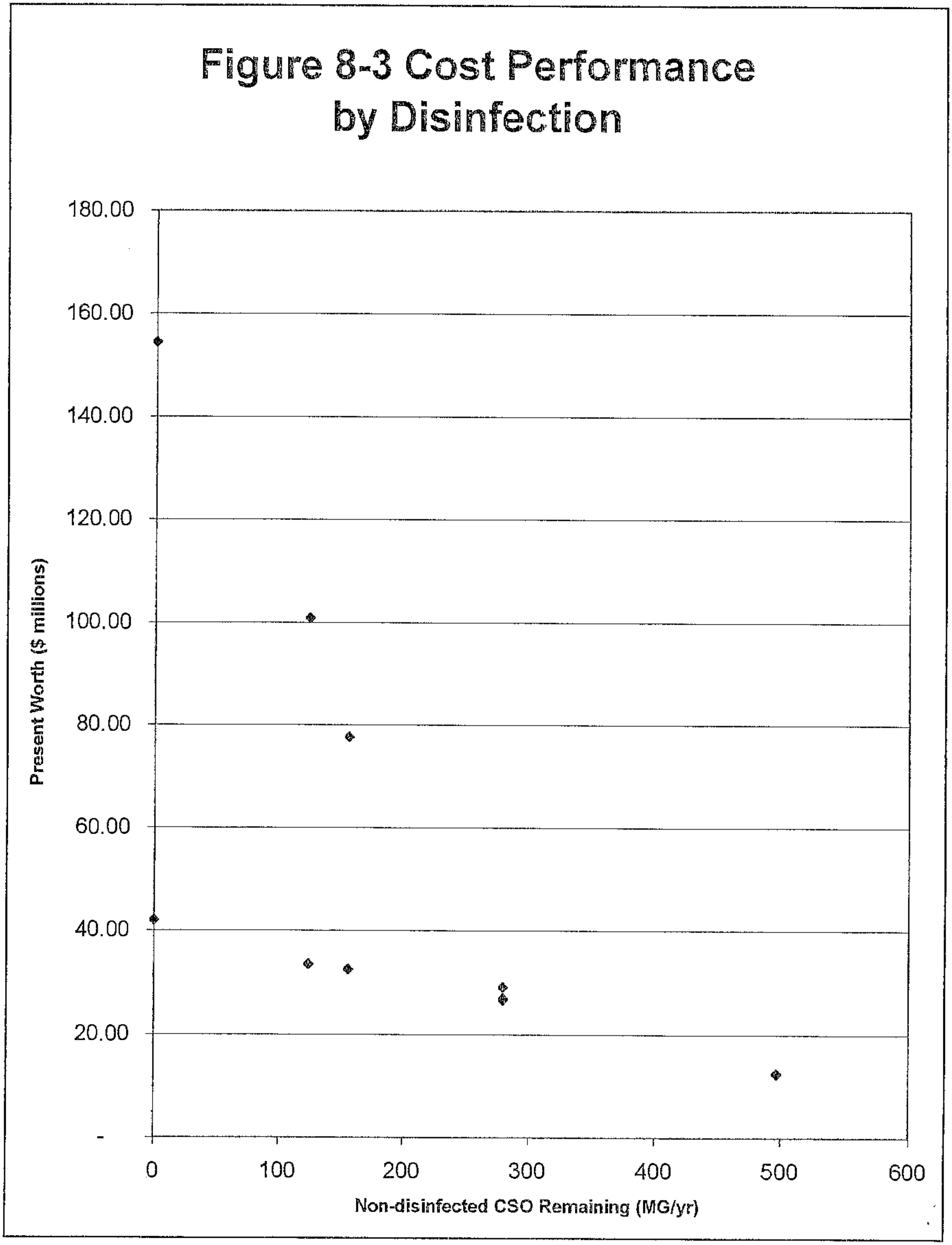


Figure 8-3 Cost Performance
by Disinfection
180.00
160.00
140.00
120.00
100.00
80.00
60.00
40.00
20.00
-
0
100
200
300
400
500
600
Present Worth ($ millions)
Non-disinfected CSO Remaining (MG/yr)

Section 9 - Financial Capability

9-A Wastewater Cost Per Household Indicator

The initial step in the analysis of the Financial Capability involves the calculation of a generalized benchmark that relates the LTCP costs and current wastewater costs to the CSO municipality's Median Household Income on an annualized basis. This Benchmark is called the Wastewater cost per Household Indicator or WW_{CPHI} as follows:

For purposes of the section the annualized cost per household is taken as annual cost of operation plus annual debt service divided by the number of households as enumerated by the 2000 Census (2,910).

$$WW_{CPHI} = \frac{\text{Annualized LTCP and Existing Wastewater costs per household}}{\text{Annualized Median Household Income}} \times 100\%$$

From the Census Bureau
the 2000 Median Household Income for Boonville was $34,913
the 2000 Median Household Income for the nation was $42,148

For the various alternatives which bracket the "Knee of the curve" a matrix of WW_{CPHI} values can be calculated as presented in Table 9-1. Using the Criteria in the guidance, the overall economic impact per household can be determined using WW_{CPHI} value. A value <1% is rated as "low", a value of 1% to 2% is rated as "medium" and values >2% are rated as "high". The impact ratings for the various alternatives are shown in the last column of the Table.

Table 9-1

Alternative	Annual WW cost	Per Household	WW_{CPHI}	Economic impact
1C – Complete Separation	$ 8,779,290.00	$ 3,016.00	8.6%	"High"
2C – Screening & Disinfection	$ 3,235,297.00	$ 1,110.00	3.2%	"High"
3C – Screening Only	$ 2,626,278.00	$ 902.00	2.6%	"High"

For all alternatives labeled as "high" the socio-economic impact shall be considered widespread.

9-B Socio-Economic Indicators Matrix (SEIM)

For WW_{CPHI} with a result greater than 1% a scoring matrix is set up to consider additional economic factors external to the actual project costs. This is labeled the Socio-Economic Indicator Matrix (SEIM). This index considers several indicators of economic health. These are put into a matrix that is presented in Table 9-2

Median Household Income

From the previous section the City of Boonville has an estimated year 2000 Median Household income of $ 34,913. The National MHI for 2000 was $42,148

Rating basis
- Weak: >25% below the National MHI
- Mid-Range: + or – 25% of the National MHI
- Strong: > 25% above the National

Boonville's MHI is 17% lower than the National MHI and is rated as "mid-range"

Average Unemployment Rate for 2000

The average unemployment rate for Boonville in year 2000 was 3.5%. The National average 4.0% from US Bureau of Labor Statistics.

Rating basis
- Weak: >1 % above National average
- Mid-Range: + or – 1% of the National average
- Strong: > 1% below the National average

Boonville's average is 0.5% below the National MHI and is rated as "mid-range"

Overall Net Debt per Capita

The Overall Net Debt per capita for Boonville was $1,094.44 (from rate accountant)

Rating basis
- Weak: >3,000
- Mid-Range: 1,000 – 3,000
- Strong: < 1,000

Boonville's Net Debt rating is "mid-range"

Bond Rating

The City of Boonville's Wastewater Utility is not rated. Use midrange for calculating the SEIM.

Property Tax Revenue Collection Rate

The property Tax Collection rate for Boonville was 99.9%

Rating basis
Weak: <94%
Mid-Range: 4% to 98%
Strong: > 98%

Boonville's Property tax collection rating is "strong"

Table 9-2 S-E Indicators Matrix Worksheet

S-E Indicator Matrix	Municipality Value	Weak, Mid-Range, or Strong	Municipality Score
Median Household Income	$ 34,913	Mid-Range	2
Tax Collection Rate	99.09%	Strong	1
Bond Rating	Non-rated	Mid-Range	2
Overall Net Debt Per Capita	$ 1,094.00	Mid-Range	2
Average Unemployment Rate, Year 2000	3.5%	Mid-Range	2
S-E Indicator Matrix Total			9
SEIM AVERAGE			**1.8**
S-E-I Matrix Strength Rating			**Mid-Range**

9-C Overall Financial Capability Matrix and Implementation Schedule

The Overall Financial Capability Matrix and Implementation Timeline Table represents the substantial economic burden realized by Boonville to fully implement the Long Term Control Plan. Table 9-3 has been prepared to display this matrix for each of the alternatives in Table 9-1 bracketing the "knee of the curve". The methodology used to determine the implementation schedule is based upon a combination of the SEIM average from Table 9-2, and the $\mathbf{WW_{CPH}}$ calculated for each Alternative in Table 9-1. Table 9-4 displays the solution Matrix used to assign the appropriate implementation schedule. The results indicate that an appropriate implementation schedule would be in the range of 10 to 20 years to reach knee of curve.

Table 9-3

Alternative	S-E Indicator Score	WW_{CPH}	Financial Capability Matrix Score	Length of time for LTCP Implementation Schedule
1C	1.8	8.6%	High	10-20 years
2C	1.8	3.2%	High	10-20 years
3C	1.8	2.6%	High	10-20 years

Table 9-4

	S-E Indicator Score	**WW_{CPH} Below 1%**	**WW_{CPH} 1% to 2%**	**WW_{CPH} Above 2%%**
	Above 2.5	Medium	High	High
	1.5 to 2.5	Low	Medium	High
	Below 1.5	Low	Low	Medium

Based upon the scores from this table the Length of Time for LTCP Implementation Schedule can be approximated as follows

High = 10-20 years
Medium = 5-10 years
Low = 5 years

Section 9 - Financial Capability

9-A Wastewater Cost Per Household Indicator

The initial step in the analysis of the Financial Capability involves the calculation of a generalized benchmark that relates the LTCP costs and current wastewater costs to the CSO municipality's Median Household Income on an annualized basis. This Benchmark is called the Wastewater cost per Household Indicator or WW_{CPHI} as follows:

For purposes of the section the annualized cost per household is taken as annual cost of operation plus annual debt service divided by the number of households as enumerated by the 2000 Census (2,910).

$$WW_{CPHI} = \frac{\text{Annualized LTCP and Existing Wastewater costs per household}}{\text{Annualized Median Household Income}} \times 100\%$$

From the Census Bureau

the 2000 Median Household Income for Boonville was $34,913

the 2000 Median Household Income for the nation was $42,148

For the various alternatives which bracket the "Knee of the curve" a matrix of WW_{CPHI} values can be calculated as presented in Table 9-1. Using the Criteria in the guidance, the overall economic impact per household can be determined using WW_{CPHI} value. A value <1% is rated as "low", a value of 1% to 2% is rated as "medium" and values >2% are rated as "high". The impact ratings for the various alternatives are shown in the last column of the Table.

Table 9-1

Alternative	Annual WW cost	Per Household	WW_{CPHI}	Economic impact
1C	$ 8,779,290.00	$ 3,016.00	8.6%	"High"
2C	$ 3,637,205.00	$ 1,249.00	3.6%	"High"
3C	$ 2,706,000.00	$ 930.00	2.7%	"High"

complete sep.
Seneca & [illegible]

For all alternatives labeled as "high" the socio-economic impact shall be considered widespread.

9-B Socio-Economic Indicators Matrix (SEIM)

For WW_{CPHI} with a result greater than 1% a scoring matrix is set up to consider additional economic factors external to the actual project costs. This is labeled the Socio-Economic Indicator Matrix (SEIM). This index considers several indicators of economic health. These are put into a matrix that is presented in Table 9-2

Median Household Income

From the previous section the City of Boonville has an estimated year 2000 Median Household income of $ 34,913. The National MHI for 2000 was $42,148

Rating basis
- Weak: >25% below the National MHI
- Mid-Range: + or – 25% of the National MHI
- Strong: > 25% above the National

Boonville's MHI is 17% lower than the National MHI and is rated as "mid-range"

Average Unemployment Rate for 2000

The average unemployment rate for Boonville in year 2000 was 3.5%. The National average 4.0% from US Bureau of Labor Statistics.

Rating basis
- Weak: >1 % above National average
- Mid-Range: + or – 1% of the National average
- Strong: > 1% below the National average

Boonville's average is 0.5% below the National MHI and is rated as "mid-range"

Overall Net Debt per Capita

The Overall Net Debt per capita for Boonville was $1,094.44 (from rate accountant)

Rating basis
- Weak: >3,000
- Mid-Range: 1,000 – 3,000
- Strong: < 1,000

Boonville's Net Debt rating is "mid-range"

Bond Rating

The City of Boonville's Wastewater Utility is not rated. Use midrange for calculating the SEIM.

Property Tax Revenue Collection Rate

The property Tax Collection rate for Boonville was 99.9%

Rating basis
Weak: <94%
Mid-Range: 4% to 98%
Strong: > 98%

Boonville's Property tax collection rating is "strong"

Table 9-2 S-E Indicators Matrix Worksheet

S-E Indicator Matrix	Municipality Value	Weak, Mid-Range, or Strong	Municipality Score
Median Household Income	$ 34,913	Mid-Range	2
Tax Collection Rate	99.09%	Strong	1
Bond Rating	Non-rated	Mid-Range	2
Overall Net Debt Per Capita	$ 1,094.00	Mid-Range	2
Average Unemployment Rate, Year 2000	3.5%	Mid-Range	2
S-E Indicator Matrix Total			9
SEIM AVERAGE			**1.8**
S-E-I Matrix Strength Rating			**Mid-Range**

9-C Overall Financial Capability Matrix and Implementation Schedule

The Overall Financial Capability Matrix and Implementation Timeline Table represents the substantial economic burden realized by Boonville to fully implement the Long Term Control Plan. Table 9-3 has been prepared to display this matrix for each of the alternatives located near the "knee of the curve". The methodology used to determine the implementation schedule is based upon a combination of the SEIM average from Table 9-2, and the $\mathbf{WW_{CPH}}$ calculated for each Alternative in Table 9-1. Table 9-4 displays the solution Matrix used to assign the appropriate implementation schedule. The results indicate that an appropriate implementation schedule would be in the range of 10 to 20 years to reach knee of curve.

Table 9-3

Alternative	S-E Indicator Score	WW_{CPHI}	Financial Capability Matrix Score	Length of time for LTCP Implementation Schedule
1C	1.8	8.6%	High	10-20 years
2C	1.8	3.6%	High	10-20 years
3C	1.8	2.7%	High	10-20 years

Table 9-4

	S-E Indicator Score	WW_{CPH} Below 1%	WW_{CPH} 1% to 2%	WW_{CPH} Above 2%%
	Above 2.5	Medium	High	High
	1.5 to 2.5	Low	Medium	High
	Below 1.5	Low	Low	Medium

Based upou the scores from this table the Length of Time for LTCP Implementation Schedule ean be approximated as follows

High = 10-20 years
Medium = 5-10 years
Low = 5 years

Section 10 - Implementation Schedule

The cost effective alternative to achieve full compliance is to implement full screening and disinfection at both CSO Basins. However, this will require expenditures beyond the Knee of the Curve and will cause a financial hardship as discussed in Section 8.

Subject to negotiation with IDEM, the City of Boonville will implement a two phase CSO Improvement project as a part of its Long-Term control plan. Based upon the results of the SRCER the City's overflows had little impact on Cypress Creek before construction of the new WWTP. With completion of this project, it is expected that the impact will be even less. The two phases will consist of the following:

Phase 1 Basin Return and Operation Modification
Documentation of CSO Impact on Cypress Creek

The first portion of this work will be to modify operational procedures and modify the basin return pumps as discussed in Section 5-A.

Concurrently with basin return modifications the City's operation staff has begun an ongoing evaluation of CSO basin operations, performance and stream impact.

This work will include obtaining the following data:

1. CSO volumes (flow meters shall be calibrated annually)
2. CSO Waste strengths, TSS, BOD, E-Coli
3. Plant flow volumes
4. Plant waste strengths
5. Rainfall (City will obtain and install a recording rain gauge to monitor both total rain and duration)
6. Upstream waste strengths
7. Downstream waste strengths

This data will be compiled for two years. During this time several representative storms shall be assessed.

Based upon this information, the City of Boonville will determine the type of screening required to capture floatables remaining in the CSO discharges, and verify that basins are

a) Capturing for treatment all streams up to 1.3 inches in one hour
b) Providing primary treatment for all streams up to 2.19 inches in one hour

All accumulated test data including locations, shall be submitted with the City's MRO's. Upon completion of the two year monitoring period the City will prepare a report documenting

1. Basin design captures up to 1.3 inches in one hour storm, and provides primary treatment of storms up to 2.19 inches in one hour.

Or

2. Recommends basin or process modification to provide the required treatment .

Note: Screening and disinfection to be Phase 2.

Phase 2 Screening of CSO

During this phase, the City will install suitable screens and mechanisms required to capture the floatables remaining in the CSO discharges and shall provide disinfection of CSO discharge as required.

Schedule

A 5-year schedule is proposed

Phase 1 – Monitoring	
Submit Revised CSO Operation Plan	June 2006
Monitoring Complete	December 2007
Evaluation of Data and Report Complete	June 2008
Phase 2 – Screening & Disinfection	
Complete PER	December 2009
Complete Plans	December 2010
Submit Revised CSO Operation Plan	June 2011
Complete Construction	December 2011

Cost of Implementation

Phase 1	
Monitoring & Evaluation & Equipment	$100,000
Basin Return Modifications	$300,000
Subtotal Phase 1	$400,000
Phase 2	
Construction	$3,800,000
Non-Construction	$660,000
Subtotal Phase 2	$4,460,000
TOTAL L.T.C.P. COST	**$4,860,000**

Project Funding

All cost comparisons used in the LTCP are based upon funding construction with a 20 year Revenue Bond sale. Grants will be considered if available for use within the proposed time scale. A preliminary estimate indicates that a 48% rate increase will be required.

Implementation Schedule Conclusion

Throughout the implementation of the LTCP, CSO monitoring will continue. The results of this monitoring will be used to determine the effectiveness of construction completed to date. Based upon actual effectiveness, the scope and timing of successive phases will be adjusted.

Upon completion, the City will reach the "Knee of the Curve".

All proposed improvements will be designed for future expansion and/or modification.

Section 10 - Implementation Schedule

Subject to negotiation with IDEM, the City of Boonville will implement a three phase CSO Improvement project as a part of its Long-Term control plan. Based upon the results of the SRCER the City's overflows had little impact on Cypress Creek before construction of the new WWTP. With completion of this project, it is expected that the impact will be even less. The three phases will consist of the following:

Phase 1 Documentation of CSO Impact on Cypress Creek

The City's operating staff will monitor, sample and analyze the current CSO operation. This work will include obtaining the following data:

1. CSO volumes
2. CSO Waste strengths, TSS, BOD, Ammonia, e-coli, floatables
3. Plant flow volumes
4. Plant waste strengths
5. Rainfall
6. Upstream waste strengths
7. Downstream waste strengths

This data will be compiled for four years. During this time several representative storms shall be assessed.

Based upon this information, the City of Boonville will determine the type of screening required to capture floatables remaining in the CSO discharges.

Phase 2 Screening of CSO

During this phase, the City will install suitable screens and mechanisms required to capture the floatables remaining in the CSO discharges.

Phase 3 Disinfection of CSO's

If data collected in Phase I substantiates that installation of disinfection equipment is warranted, then this work will be completed in Phase 3.

Replaced 1/06

Schedule

Phase 1 – Monitoring	
Monitoring Complete	December 2005
Evaluation of Data Complete	December 2006
Phase 2 – Screening	
Complete PER	December 2007
Complete Plans	December 2008
Complete Construction	December 2009

Phase 3 – Disinfection	
Complete PER	December 2010
Complete Plans	December 2011
Complete Construction	December 2012

Cost of Implementation

Phase 1	
Monitoring & Evaluation $10,000/yr.	$40,000
Subtotal Phase 1	$40,000
Phase 2	
PER	$25,000
Construction	$1,000,000
Non-Construction	$135,000
Subtotal Phase 2	$1,160,000
Phase 3	
PER	$25,000
Construction	$2,800,000
Non-Construction	$560,000
Subtotal Phase 3	$3,385,000
TOTAL L.T.C.P. COST	**$4,585,000**

Implementation Schedule Conclusion

Throughout the implementation of the LTCP, CSO monitoring will continue. The results of this monitoring will be used to determine the effectiveness of construction completed to date. Based upon actual effectiveness, the scope and timing of successive phases will be adjusted.

Upon completion of Phase 2, the City will reach the "Knee of the Curve".

Section 11 - Post-Construction Compliance Monitoring Program

As discussed in Section 10 Boonville will implement a Post Construction Compliance Monitoring Program to evaluate the effectiveness of the construction completed. This program will be incorporated in the CSO Operation Plan. The compliance monitoring program will consist of compiling the following records in a monthly report.

1. Daily precipitation
2. Flow to WWTP
3. Flow processed through CSO facility
4. Solids removed at CSO facility
5. Solids & floatables removed at each CSO
6. Daily sample results for CSO facility discharge BOD, TSS, Ecoli
7. Quarterly base line samples upstream and downstream as per SRCER

Annually the POTW operator will review operational results and compare with predicted results.

During design of each succeeding phase the results of Post Construction Monitoring will be used to modify the scope and design of the next phase. During preparation of the next phase's PER the LTCP will be reviewed and modified as needed to reflect current operational and financial conditions.

Section 12 - Operational Plan Revisions

I. Proper Operation & Regular Maintenance Programs for the Collection System and the CSO's

A. Update this subsection with:

1. The map of the lower Cypress Creek area and photos of the existing CSO structures.

B. Update this subsection with an additional paragraph which reads as follows:

It is recommended that a dedicated crew, whose first priority would be to the maintenance of the CSO's and the collection of pertinent data herein, be assigned initially. This crew should be instructed as to the nature and purpose of the program. The superintendent should make available the guidelines established for the program and importance of a conscience effort to maintain the program in a professional manner. Duties of the crew would be at least the following, but not limited to:

1. Daily visits to the CSO structures.

2. Removable of any accumulated debris as necessary to prevent odors and inefficiency of the intended purpose of all mechanisms and appurtenances.

3. Reading and recording flow data from flow meters.

4. Regular charting and graphing of recorded data. Data will then be available to the superintendent, engineers, and interested parties showing that the program is in line with expected outcomes.

C. The City will annually review its operating plan and modify it accordingly. All revisions shall be promptly submitted to IDEM for approval.

The first revision will be submitted by June 2006.

Section 12 - Operational Plan Revisions

I. Proper Operation & Regular Maintenance Programs for the Collection System and the CSO's

A. Update this subsection with:

1. The map of the lower Cypress Creek area and photos of the existing CSO structures.

B. Update this subsection with an additional paragraph which reads as follows:

It is recommended that a dedicated crew, whose first priority would be to the maintenance of the CSO's and the collection of pertinent data herein, be assigned initially. This crew should be instructed as to the nature and purpose of the program. The superintendent should make available the guidelines established for the program and importance of a conscience effort to maintain the program in a professional manner. Duties of the crew would be at least the following, but not limited to:

1. Daily visits to the CSO structures.

2. Removable of any accumulated debris as necessary to prevent odors and inefficiency of the intended purpose of all mechanisms and appurtenances.

3. Reading and recording flow data from flow meters.

4. Regular charting and graphing of recorded data. Data will then be available to the superintendent, engineers, and interested parties showing that the program is in line with expected outcomes.

Replaced 1-28-06

Section 13 – Conclusions

The City of Boonville faces major financial and engineering tasks as the LTCP is implemented. The CSO system developed in the 1930's includes multiple large diameter (7') sewers draining 1,350 acres. Some of these sewers pass under existing homes and structures making separation extremely difficult. The large drainage area makes treatment options massive in size. These difficulties are not impossible to overcome, but the cost will be significant.

The $4,860.000 million implementation cost seems low at first glance, but Boonville is unique in that over $10,000,000 has been spent to construct a new WWTP on top of over $2,000,000 spent on CSO improvements in 1998. In total, over $16,000,000 will be the true implementation cost for Boonville. This represents nearly $5,700 per household. The annualized wastewater cost per household for just screening will be 2.6% of the median family income. Full disinfection and screening will be 3.2% of the median family income.

It will be critical that Boonville and IDEM cooperate in the effort to implement this plan.

Section 13 – Conclusions

The City of Boonville faces major financial and engineering tasks as the LTCP is implemented. The CSO system developed in the 1930's includes multiple large diameter (7') sewers draining 1,350 acres. Some of these sewers pass under existing homes and structures making separation extremely difficult. The large drainage area makes treatment options massive in size. These difficulties are not impossible to overcome, but the cost will be significant.

The $4.56 million implementation cost seems low at first glance, but Boonville is unique in that over $10,000,000 has been spent to construct a new WWTP on top of over $2,000,000 spent on CSO improvements in 1998. In total, over $16,000,000 will be the true implementation cost for Boonville. This represents nearly $5,700 per household. The annualized wastewater cost per household for just screening will be 2.7% of the median family income. Full disinfection and screening will be 3.6% of the median family income.

It will be critical that Boonville and IDEM cooperate in the effort to implement this plan.

Replaced
2-28-06

Section 14 –Compliance with the Nine Minimum Controls

The City of Boonville has prepared a CSOP to address and comply with the nine minimum CSO controls. These controls are as follows:

I. Proper Operation & Regular Maintenance Programs for the Collection System & CSO's

A. System Inventory

An inventory of the CSS is presented in the CSOP, as is a discussion of the existing WWTP. An overall sewer map and a plant flow diagram are available.

Due to the systems age, manhole elevations and slopes are not available. The City will obtain this data in a 10-year mapping program. Plans are available for the major interceptors.

B. The current maintenance program is includes regular sewer and catch basin cleaning.

II. Maximum Use of the Collection System for Storage

The use of the collection system for storage is maximized. The Diversion Structure at both the North and South CSO Basins causes the Large Diameter Combined Sewers to fill prior to overflowing. No additional storage is available without causing upstream flooding.

III. Review & Modification of Pretreatment Programs to Assure CSO Impacts are Minimized

The City has no major industrial contributor.

IV. Maximization of Flow to the POTW for Treatment

The maximization of flow to the POTW is discussed in the LTCP. During storm events the operator can now take up to 9 MGD through the plant. Modifications are proposed to take additional flow.

V. Prohibition of CSO Discharges During Dry Weather

Dry weather CSO discharges are discussed in the CSOP. In 1998, improvements were made to eliminate these.

VI. Control of Solid Floatable Materials in CSO Discharges

The CSO Basins provide primary settling for solids control. Some floatables appear to be captured as well. The proposed plan includes additional services to obtain document compliance.

VII. Pollution Prevention Program

The City's ongoing pollution prevention programs including public education, street sweeping, inlet/catch basin inspection and cleaning and record keeping.

VIII. Public Notification

Public Notification plan for Boonville has been prepared, approved and is implemented.

IX. Monitoring To Characterize CSO Impacts Identify Program CSO Points, and Identify the Effectiveness of the Previous 8 Controls

The City of Boonville has completed and submitted a stream reach characterization and evaluation report. The results of the report are summarized in Section 3 of the LTCP. In Section 11 of the LTCP a Post Construction Compliance Monitoring Program is proposed.

Additional monitoring is proposed to document compliance.

Section 14 –Compliance with the Nine Minimum Controls

The City of Boonville has prepared a CSOP to address and comply with the nine minimum CSO controls. These controls are as follows:

I. Proper Operation & Regular Maintenance Programs for the Collection System & CSO's

A. System Inventory

An inventory of the CSS is presented in the CSOP, as is a discussion of the existing WWTP. An overall sewer map and a plant flow diagram are available.

Due to the systems age, manhole elevations and slopes are not available. The City will obtain this data in a 10-year mapping program. Plans are available for the major interceptors.

B. The current maintenance program is includes regular sewer and catch basin cleaning.

II. Maximum Use of the Collection System for Storage

The use of the collection system for storage is maximized. The Diversion Structure at both the North and South CSO Basins causes the Large Diameter Combined Sewers to fill prior to overflowing. No additional storage is available without causing upstream flooding.

III. Review & Modification of Pretreatment Programs to Assure CSO Impacts are Minimized

The City has no major industrial contributor.

IV. Maximization of Flow to the POTW for Treatment

The maximization of flow to the POTW is discussed in the LTCP. During storm events the operator can now take up to 9 MGD through the plant. No additional flow can be taken through the plant without washing out the aeration basin solids.

V. Prohibition of CSO Discharges During Dry Weather

Dry weather CSO discharges are discussed in the CSOP. In 1998, improvements were made to eliminate these.

VI. Control of Solid Floatable Materials in CSO Discharges

The CSO Basins provide primary settling for solids control. Floatables appear to be captured as well. The proposed plan includes additional monitoring to document compliance.

VII. Pollution Prevention Program

The City's ongoing pollution prevention programs including public education, street sweeping, inlet/catch basin inspection and cleaning and record keeping.

VIII. Public Notification

Public Notification for Boonville's CSOs consist of signage at the CSOs. As new rules are developed for public notification are promulgated the City will modify its program accordingly.

IX. Monitoring To Characterize CSO Impacts Identify Program CSO Points, and Identify the Effectiveness of the Previous 8 Controls

The City of Boonville has completed and submitted a stream reach characterization and evaluation report. The results of the report are summarized in Section 3 of the LTCP. In Section 11 of the LTCP a Post Construction Compliance Monitoring Program is proposed.

APPENDIX "A"

PUBLIC MEETING RECORDS

FIRST MEETING

11-14-02

BOONVILLE L.T.C.P
CITIZEN ADVISORY COMMITTEE
MINUTES OF NOVEMBER 14, 2002

Mayor Hendrickson called meeting to order and introduced members present those being Mayor Hendrickson, Ron Tubbs (Board of Works & City Council), Rob Burton (U.S. Filter, Boonville), Steve Byers (Fire Chief), Robert Stone (Downstream property owner), David Dahl (Midwestern Engineers Inc.).

Mr. Dahl then discussed the duties of the Citizen Advisory Committee summarized in a handout. The first chore of the committee is to review the receiving stream (Cypress Creek) and identify sensitive areas. The second chore will be to review the system characterization and identify control alternative to be considered. The third chore will be to review cost effective analysis of selected alternatives and evaluate the financial impact.

In the discussion which followed Mr. Stone reported that he was in possession of several reports on Cypress Creek dating back to the 60's. He has been active for many years in efforts to improve the Cypress Creek watershed especially flooding and water inundation due to mining activities. He will deliver these reports to Mr. Burton for copying.

Mr. Burton reported that his staff is compiling MRO's and flow data for use by Midwestern Engineers.

The committee identified two potential areas of concern. During flood events backwater from Cypress Creek can reach the neighborhood of the Jr. High property. Similarly the High School Athletic Facilities are inundated if existing culverts are not maintained. The Committee discussed flooding of concession stand; old stand flooded, new stand has not been flooded. Big E Project has greatly helped flooding in the area. Both areas will be discussed in the Long Term Control Plan.

The next meeting will be held at 9:00am (local time) on November 26, 2002. The agenda being to discuss sensitive areas.

2. PRESENTATION OF LTCP PROCESS

- What is an LTCP?

  All Communities with combined sewer systems are required by EPA/IDEM to prepare a Long Term Control plan to address how the communities will prevent/reduce contamination from their combined sewer overflows.

- What is a combined sewer overflow (CSO)?

  Many older sewer systems were designed to carry both sanitary waste and storm water in the same pipe. This originally discharged untreated downstream of builtup areas. In the mid part of the 20th century treatment plants were constructed to reduce the pollution caused by sewer discharges. Due to economics plants were designed to treat dry weather flows only, with storm flows in excess of plant capacity being a discharged through overflow points – CSO's.

- What is IDEMS CSO policy?

  The following two pages are copied from the L.T.C.P. guidance document

I. GENERAL PURPOSE OF THE INDIANA CSO POLICY

The federal and state CSO policies are divided into two phases. Phase I focuses on the technology-based (referred to as the "nine minimum controls") that maximize the existing infrastructure. Phase II will generally require capital expenditures to meet water quality standards if Phase I proves to be inadequate. The implementation of Phase II CSO controls may be done in a phased manner over several five-year permit cycles, if necessary.

Phase I - Implementation and documentation of the Nine Minimum Controls (Technology-Based Standards).

1. Proper operation and regular maintenance of the collection system;
2. Maximum use of the collection system for storage of excess flows;
3. Review and modification of Industrial Wastewater Pretreatment programs;
4. Maximization of flow to the POTW for treatment;
5. Prohibition of CSO discharges during dry weather;
6. Control of solid and floatable materials in CSO discharges;
7. Pollution prevention programs (source control or source reduction);
8. Public notification to ensure that the public receives adequate notification of CSO occurrences and CSO impacts; and
9. Monitoring to characterize CSO impacts, identify problem CSO points, and identify the effectiveness of the previous 8 controls. The ninth minimum control is implemented through the Stream Reach Characterization and Evaluation Protocol and Report (SRCER).

Phase II - Long Term Control Plan (LTCP) Finalization and Implementation (Water Quality-Based).

1. Sensitive areas and actual recreational uses defined and given the highest priority for CSO control,
2. Public participation in the selection and identification of priority areas and CSO controls,
3. Characterization, monitoring, and modeling as the basis for knee-of-the-curve or presumption approach in selection of CSO control alternatives,
4. Evaluation of an array of control alternatives ranging from "no action" to "complete

elimination or capture" of CSO discharges,

5. Evaluation of maximization of wet weather flows at the existing treatment plant,

6. Cost vs. performance considerations for screening and ranking of control alternatives,

7. Implementation schedule for CSO controls,

8. Affordability analysis (ability of a municipality to pay for CSO controls over what period of time),

9. Post-construction compliance monitoring program, and

10. CSO Operational Plan revisions to reflect changes resulting from construction of CSO controls.

3. **DISCUSSION OF COMMITTEE DUTIES**

- The committee was formed to facilitate public participation in the LTCP process.

- The committee will review and comment on the following:

  - Consideration of sensitive areas
  - System characterization and control alternatives to be considered
  - Cost effective analysis of selected alternatives & financial impact

4. EVALUATION OF SENSITIVE AREAS

The following six pages were copied from the State's Guidance document

IV. CONSIDERATION OF SENSITIVE AREAS

A. Identification

The USEPA's National CSO Control Policy and Indiana CSO Strategy identify elimination, relocation or control of CSO discharges to sensitive areas as being the highest priority requirement for the development of the Long Term Control Plan. This section therefore, is designed to provide CSO communities with specific guidance with respect to identifying sensitive areas within a CSO community and a decision-making process for identifying appropriate CSO control measures that adequately address the sensitive areas.

"Sensitive Areas", means waters impacted by CSO discharges which must be given the highest priority for CSO discharge elimination, relocation, or control. Examples of sensitive areas include:

- Habitat for threatened or endangered species
- Primary Contact Recreational Areas such as swimming and water skiing areas
- Drinking Water Source Waters
- Outstanding State Resource Waters or Outstanding National Resource Waters

The EPA's CSO Control Policy states, that for sensitive areas, the LTCP should:

1. prohibit new or significantly increased overflow volumes into the sensitive areas;
2. eliminate or relocate overflows that discharge to sensitive areas:
   a. wherever physically possible and economically achievable, except where elimination or relocation would provide less environmental protection than additional treatment, or;
   b. where elimination or relocation is not physically possible and economically achievable, or would provide less environmental protection than additional treatment, provide the level of treatment for remaining overflows deemed necessary to meet Water Quality Standards for full protection of existing and designated uses;
3. where elimination or relocation has been proven not to be physically possible and economically achievable, permitting authorities should require, for each subsequent permit term, a reassessment based on new or improved techniques to eliminate or relocate, or on changed circumstances that influence economically feasible.

The implication of item 3 above is simply that even if it is not physically possible and economically achievable to eliminate or relocate overflows to sensitive areas when the LTCP is first approved, it does not relieve the community of the responsibility to continue to evaluate and assess the situation over time. As technologies or economic circumstances change with time, it may become clear that the existing CSO can be eliminated or relocated.

It should be noted that for this element of the LTCP, the relative cost-effectiveness of particular control measures is not analyzed. Such analysis is part of the "Evaluation of Alternatives" element of the LTCP. The intent of this element is to clearly demonstrate that consideration of sensitive areas

has been accomplished through identifying the sensitive areas and determining the type of controls that are physically achievable.

The LTCP should clearly outline a process for reassessing the stream for new sensitive areas or areas that no longer fit the criteria for sensitive areas. Additionally, the permit holder may be required by IDEM to move up the priority for a particular CSO or group of CSOs on a particular stream segment, if it is shown that the previously designated "non-sensitive" segment for the primary contact recreation criteria should be changed to "sensitive."

B. Receiving Stream Sensitive Areas Identification & Documentation

In the flowcharts that follow, a simple process is suggested for identifying the sensitive areas along the receiving stream segments that may be influenced by CSO outfalls. This process is intended to be applicable to any size community. The process has two outcomes: 1) establish specific stream segments within sensitive areas; and 2) determine whether elimination/relocation treatment alternatives or pollution prevention measures will apply as the control measures for the CSOs within sensitive areas. It must be understood that because sensitive areas must receive top priority, a "no action" alternative selection (due to cost, physical constraints, or any other obstacle) is not acceptable.

In FIGURE 1, the first of the two processes is illustrated. In Step 1, the permit holder documents all known areas along the receiving stream that could be considered as "sensitive areas" according to the criteria above. Some possible sources of information regarding the location of these sensitive areas can be obtained from; Indiana Department of Environmental Management, Indiana Department of Natural Resources, US Fish & Wildlife Service, US Army Corps of Engineers, state and local health departments. Also, surveys of residents along the river and users of the water should be used for confirming locations of recreational sensitive areas.

Once the sensitive areas have been identified, they should be added to the map showing the locations of the CSOs, as illustrated in Step 2. All public access points and stream segments designated as OSRW should be identified on the map. The location of any endangered or threatened species' habitat that are influenced by the streams should also be included on the map.

Once the sensitive areas have been mapped, Step 3 suggests that a detailed survey be conducted along the receiving stream segments to verify sensitive areas, and to identify and document any additional sensitive areas. It is recommended that professionals in the disciplines of field biology and ecology participate in this survey work. Such individuals can be contacted through local colleges and universities, State and Federal regulatory agencies, or private foundations such as conservation or environmental groups, or other groups such as paddlesport clubs or fishing organizations.

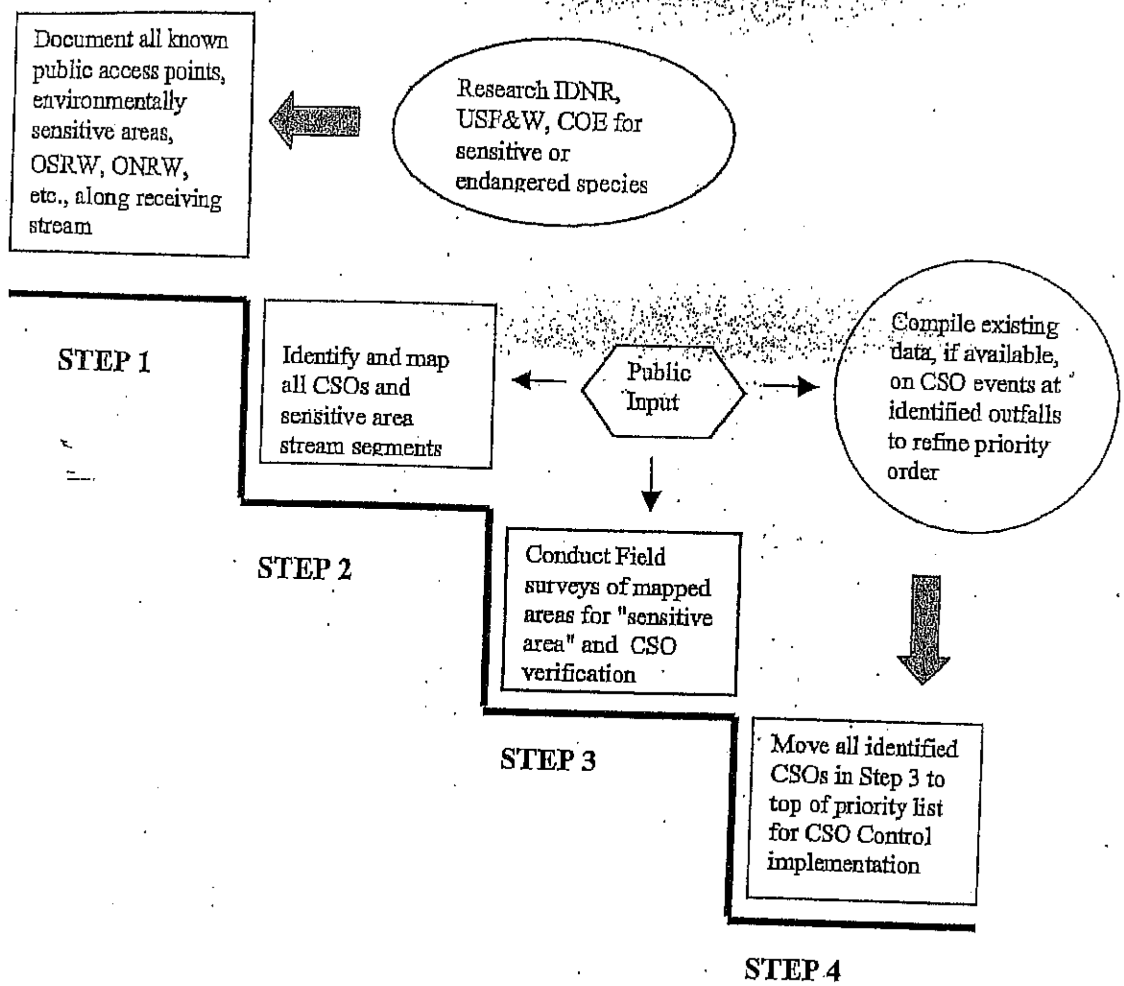
Field verified CSOs in documented sensitive areas are to be placed as the top of the priority list for CSO control implementation in the LTCP. It is strongly recommended that the permit holder seek input from the affected public on the identification of the sensitive areas and the corresponding relevant CSOs at this point in the process.

It is important that the public be fully informed on the criteria used to establish these areas and that specific measures will be implemented to remove the CSO impacts that currently exist within these sensitive areas.

Step 4 is the final step in this initial "sensitive area" priority consideration process. Once the areas have been established and the CSOs identified for priority control implementation, the community may wish to prioritize the order of implementation of controls based on the frequency and volume of individual CSO discharges or the mass loading of specific pollutants. Data from field observations or hydraulic models may be used to identify the CSOs having the greatest potential impacts on sensitive areas. This does not, however, imply that the remaining, seemingly lesser impacting CSO within the sensitive areas can be ignored. These also must be controlled. But, the data may infer that certain CSO facilities have greater contribution to the water quality concerns, and controlling those first may result in bringing protection to the sensitive area and improving the water quality standards within that segment sooner.

If data do not exist, each CSO contribution to a sensitive area should be considered equal in priority when considering control alternatives until data are acquired (through the implementation of the LTCP) that justifies specific priority actions.

Figure 1: Receiving Stream Sensitive Area Identification and Documentation



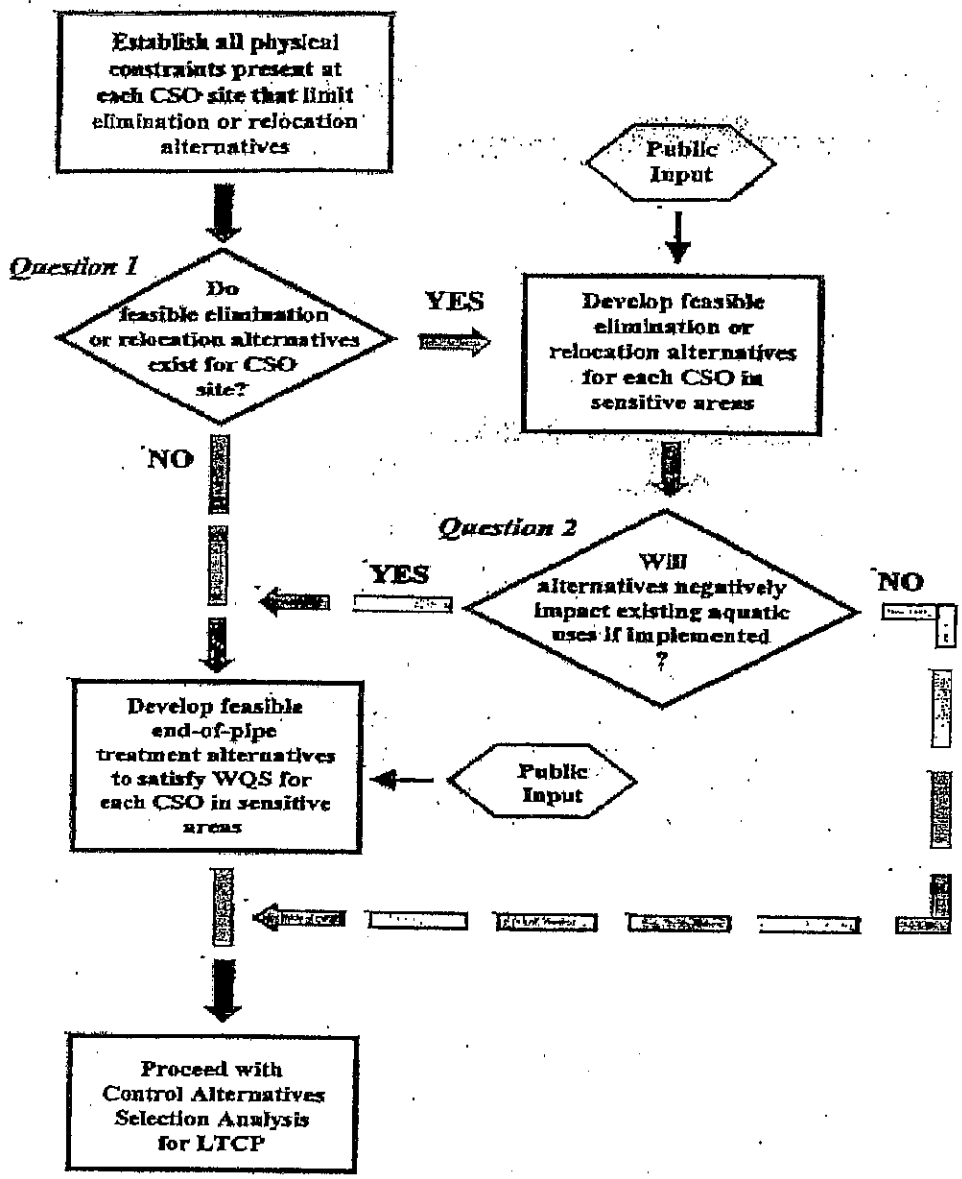
C. Establishing Type of CSO Controls in Sensitive Areas

Next, the permit holder should proceed with establishing the levels of control for all the CSOs in the sensitive areas according to the process below in FIGURE 2. Determining the type of control alternative that is appropriate for those CSOs in the sensitive areas is the basis for the process charted in FIGURE 2. The State recognizes that applying complete elimination or relocation alternatives to each and every CSO within a sensitive area may not in every case be feasible due to a variety of constraints that may arise. In the urbanized areas of many CSO communities, both small and large, relief points in the combined systems were often built immediately adjacent to the receiving stream and urbanization grew around it. Consequently, it may be hard to eliminate the relief point because of the physical obstacles present, or because it would not be economically achievable. Use the information as a background, in the first step of FIGURE 2, the permit holder details all constraints associated with each CSO within the sensitive area. These include, but may not be limited to, physical constraints, existing major utilities, and prominent topographic features. Also, sensitive environmental areas shall present constraints to be protected such as; wetlands, bogs, protected riparian habitats, or waterfowl sanctuaries.

Once the constraints have been identified, the permit holder must answer Question 1 in Figure 2. Whether, in light of the constraints, eliminating or relocating the CSOs located in the sensitive areas is physically possible and economically achievable. The intent is to determine the possibility of elimination or relocation based simply on the physical constraining factors, not on cost. The opportunity to evaluate the cost is presented in the cost analysis section of the evaluation of alternatives element of the LTCP. It is assumed that if elimination or relocation is not completely constrained by existing physical, features, then the elimination or relocation is deemed possible with cost considerations becoming part of the LTCP's economic analysis. In this situation, the CSO municipalities shall consider modifications or abatements in the combined sewer system up-pipe from the discharge point.

If the answer to Question 1 is Yes, the permit holder proceeds with developing the concepts for alternative(s) that will eliminate or relocate the CSOs in question away from the sensitive areas. If the answer is No, then the implication is that the permit holder has no choice but to keep the CSO relief point at its existing discharge point and develop feasible treatment processes that can be applied to the end-of-pipe. The treatment process must be selected such that the water quality standards are satisfied. These alternatives are then entered into the overall LTCP CSO control alternatives analysis element.

It should be noted that as indicated in FIGURES 1 and 2, there are key points where public input is strongly recommended and should be accurately documented.



PROCESS 2:
Establishing Type of CSO Controls in Sensitive Areas

FIGURE 2

D. Sensitive Areas Documentation within the Long Term Control Plan

The LTCP documents should include the following:

1. a scaled map of the receiving water network showing the identified sensitive areas and CSO locations (The scale of this map should be such that all features are clearly denoted, with 1"=1000' a recommended minimum);

2. documentation of the public participation and decision-making process for selecting elimination and/or relocation alternatives or treatment technique alternatives; and

3. scaled map showing the conceptual layout of the scope of the alternatives developed, which will undergo further scrutiny as part of the economic analysis element of the LTCP.

The National and State CSO Policy is explicit with regard to consideration of sensitive areas in the Long Term Control Plan preparation. In essence, the permit holder has two basic choices for addressing the discharges in sensitive areas. The policy is CSO discharges within identified sensitive areas must be eliminated, or relocated, to non-sensitive areas. If it is demonstrated that eliminating or relocating the CSO is not physically possible and/or economically achievable, then some type of treatment technique alternative must be instituted at or before the point of discharge, so the CSO does not cause or contribute to the exceedance of water quality standard.

SECOND MEETING

11-26-02

CITY OF BOONVILLE L.T.C.P
CITIZENS ADVISORY COMMITTEE
MINUTES OF NOVEMBER 26, 2002

Mayor Hendrickson called meeting to order. Members present, being Mayor Hendrickson, Ron Tubbs, Steve Byers, Rob Burton, Robert Stone, and David Dahl.

Mr. Dahl presented minutes of November 14, 2002 meeting and apologized for leaving Mr. Tubbs and Mr. Byers names off of the list of attendees. Mr. Burton noted that Mr. Ruff did not attend, during discussion of flooding at the High School. The Committee discussed that the old concession stand flooded, but the new one has not been flooded. The Big E project has greatly helped flooding in the area. Mr. Dahl was instructed to revise minutes accordingly.

Mr. Dahl began discussion of sensitive areas by reviewing location of CSO, using a quadrangle map. Photos of various portions of Cypress Creek were also reviewed. These photos show that usage along the creek is agricultural with steep Creek banks. It was determined that no primary contact recreational areas such as, swimming and water skiing areas exist along Cypress Creek, nor is the Creek used as a source of drinking water.

After discussion, the Committee then reviewed a hand out summarizing the findings of the City's SRCER. During the SRCER the tests showed, that the CSO's meet the City's NPDES limits for BOD, and ammonia, pH, E coli, and D.O. Cyanide and lead concentrations were less than 0.003 mg/l for cyanide and less than 0.013 mg/l for lead, both below the MCL for drinking water.

It was noted that E coli levels upstream of the North CSO exceeded 125 colonies /100ml. TSS is the CSO discharges exceed the plants NPDES limits, but are well below the TSS in the upstream samples. It was concluded that the CSO's had no impact on the receiving stream.

Next the committee reviewed a hand out of portions of IDEM's 1998 303 (d) and 2002 303(d) draft list of impaired water bodies. Cypress Creek from Booneville to the Ohio River is on both lists. In 1998, the listing was for high chlordane levels. In 2002, the listing is for chlordane, sulfates, total dissolved solids, and E coli. In October 2002, Cypress Creek chlordane was included in a list of parameters, recommended to be delisted. The inclusion of sulfates and total dissolved solids is a reflection of coal mining in the watershed. E coli is included due to presence of the Boonville CSO's.

Mr. Stone distributed copies of a DNR report prepared in 1980, which discusses the condition of Cypress Creek. Members were encouraged to review the report.

Mr. Dahl then handed out copies of 327 IAC2-1-2, which contains the list of outstanding state resource waters. Cypress Creek is not listed.

A request has been made to Fish and Wildlife to review endangered species in the area.

At the next meeting, a recommendation on sensitive areas shall be considered for transmitting to the Board of Works.

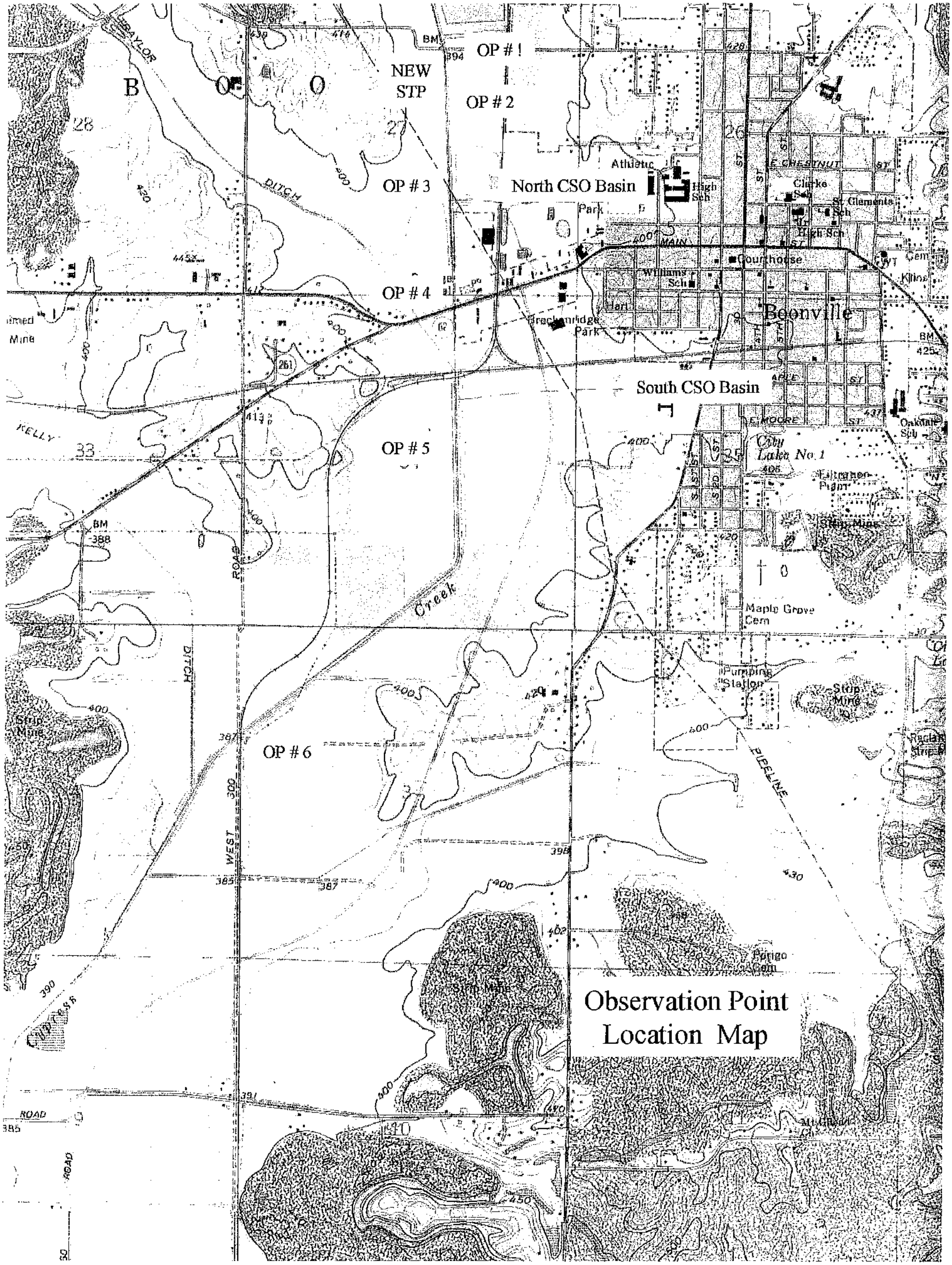
The next meeting will be on December 11, 2002.

CITY OF BOONVILLE L.T.C.P
CITIZENS ADVISORY COMMITTEE
AGENDA
NOVEMBER 26, 2002

1. Approve minutes of November 26, 2002 meeting

2. Discuss Sensitive areas.
   a. Review location of CSO's
   b. Review findings of SRCER
   c. Review IDEM 303 (d) list
   d. Review other reports
   e. Identify impacts to
      - Habitat for threatened or endangered species
      - Primary contact recreational areas
      - Drinking water source water
      - Outstanding State or National resource waters

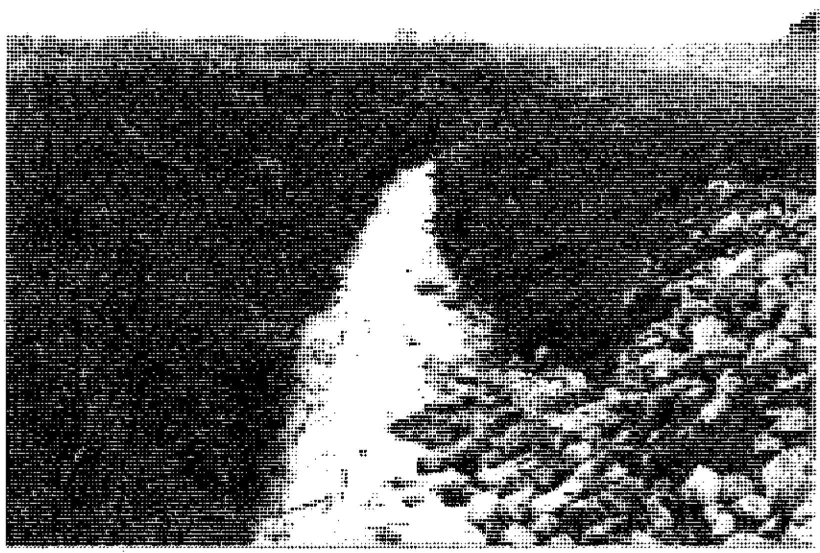
3. Next Meeting


OP # 1
NEW STP
OP # 2
OP # 3
North CSO Basin
OP # 4
South CSO Basin
OP # 5
OP # 6
Boonville
Courthouse
Athletic
High Sch
Park
Breckenridge Park
City Lake No 1
Maple Grove Cem
Pumping Station
Strip Mine
PIPELINE
Creek
DITCH
WEST 300 ROAD
Observation Point Location Map

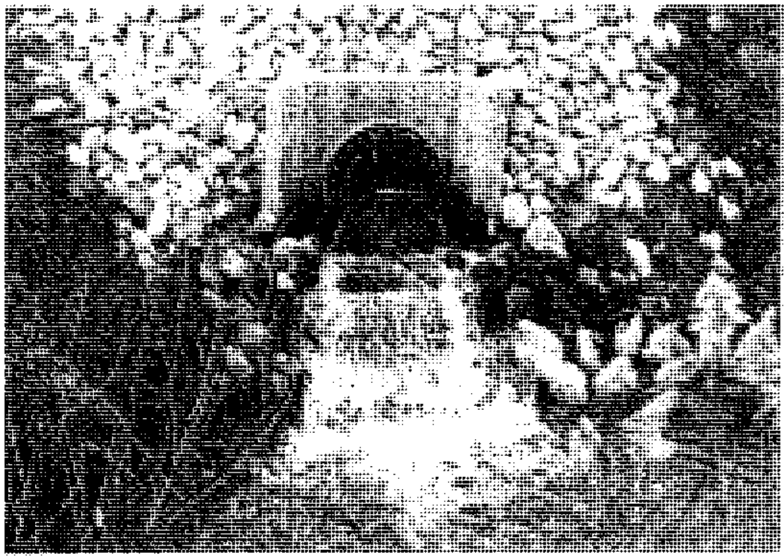
Observation Point # 1

Above: Upstream view of Cypress Creek from County Road Bridge 200 feet east of New STP entrance.

Below: Downstream view from the same bridge. The right side of the photo shows the edge of the New STP property.



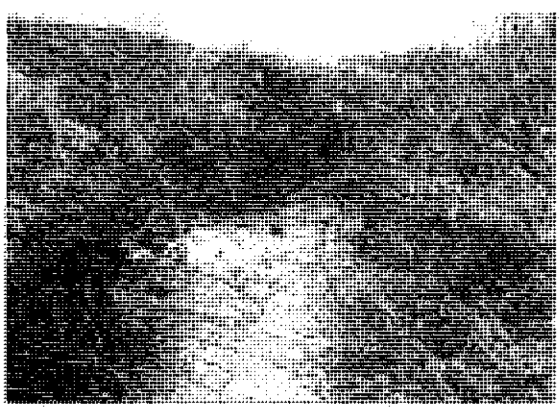
Observation Point # 2



Above: STP Effluent Outfall Structure into Cypress Creek

Below Left: Upstream view of Cypress Creek at the STP Outfall Structure

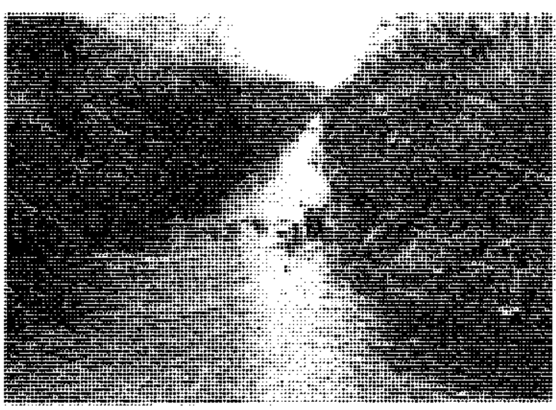
Below Right: Downstream view at same location.

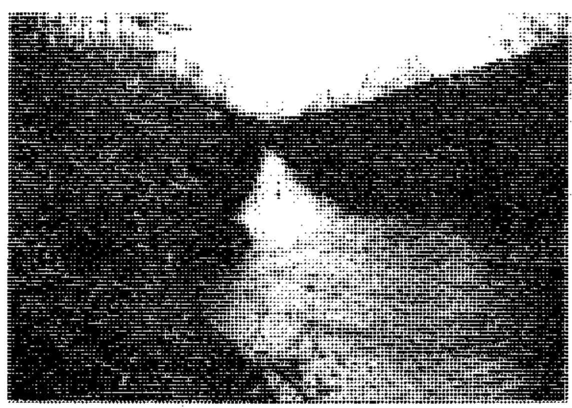


Observation Point # 3

Above: Overflow pipe and channel from North CSO Basin. Confluence into Cypress Creek can be observed at bottom of photo. Creek flow is left to right.

Below Left and Right: Upstream and downstream view of Cypress Creek.



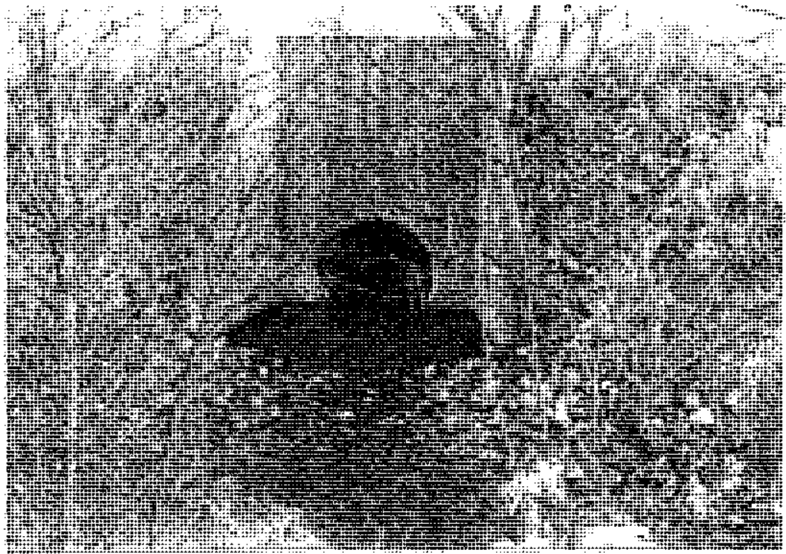


Observation Point # 4

Above: Upstream view of Cypress Creek as seen from the bridge on Hi-Way 62.

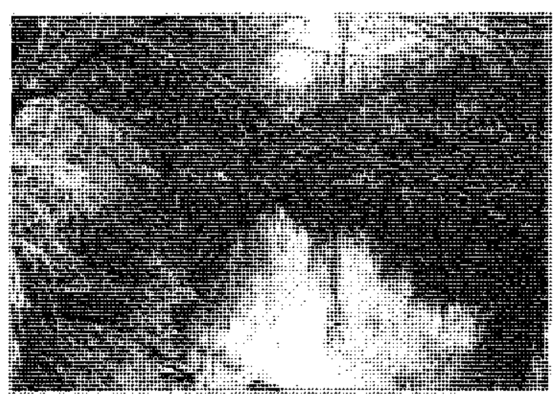
Below: Downstream view from the same observation point.

Observation Point # 5



Above: Headwall structure at discharge point from South CSO Basin. Overflow from the pond enters CypressCreek at this point. Creek confluence can be observed at bottom of photo flowing from left to right.

Below Left and Right: Upstream and downstream view of creek as observed from the same point.



Observation Point # 6

Above: Upstream view of Cypress Creek from bridge on Eskew Road, shown as CR 300 W. on map. This point is approximately 1.5 miles downstream from observation point # 5. The physical characteristics of this creek have been virtually the same at all observation points. Open farm fields border each side of the creek and the creek banks are steep and brush covered.

Below: Downstream view of creek from the same bridge.

Stream Reach Characterization and Evaluation Study and Report

Summary of Data

The following is a summation of the data compiled over a three (3) year period and includes but is not limited to:

1. Daily precipitation amounts (Section 6)
2. Duration of a rainfall event in terms of both days and hours as it pertains to CSO discharge events. (Section 6)
3. Copies of CSO reports as submitted to IDEM (Section 12 and 13)
4. Flow records that pertain to the discharge of water from the designated CSO structures (Sections 9, 10 and 11)
5. Laboratory results of analysis for specified parameters of CSO discharge as well as samples of receiving stream at time of possible CSO influence. (To reduce paper work and IDEM review time, lab sheets are not included herein. They will, however, be made available upon request.

A summation of the overall results in terms of impact and influence caused by overflow from the identified CSO structures upon the receiving stream would definitely fall within the category of no noticeable impact. This is based on the analysis of water in the discharge stream itself as well as analysis of water within the receiving stream both above and below the confluence of the CSO discharge point. Each analyzed parameter will now be discussed individually in terms of CSO control efficiency and receiving stream impact. The following statements are evidenced by the analyzed pollutant values given both in the CSO Event Section as well as in the section containing laboratory results of each monitored overflow event.

Biochemical Oxygen Demand (BOD)

BOD concentrations in the CSO discharges at both the North and South structures show values of < 5.0 mg/L. This is well below the allowed limit as it pertains to the Wastewater Treatment Plant. The NPDES permit limit for BOD concentration is 20 and

25 mg/L for Summer and Winter months respectively. The CSOs do not impact the receiving stream in terms of BOD.

Total Suspended Solids (TSS)

The TSS values displayed at both the North and South CSO structures for the monitored overflow events are above the limits for the Wastewater Treatment Plant, but are well below the values of the receiving stream both above and below the CSO's discharge points. All values are above the TSS concentrations shown for dry weather analysis, but this would be expected since the stream would be quiescent during normal dry weather periods and turbulent during rainfall events. The contributing factor to the TSS quantity would be inorganic material such as sand and silt that is already present on the stream floor as well as that which is washed in from small tributaries along the main stream. Being inorganic in nature these solids would have no biological impact upon the receiving stream in terms of oxygen depletion. Also supporting this statement is the analysis for Dissolved Oxygen (DO). There is no evidenced decline in the DO concentration during the monitored CSO events. The values of the CSO discharge compared to the stream values both above and below the points of discharge vary by only a few tenths of a milligram per liter. Based on the available data pertaining to TSS, there is no evidenced impact from the CSO discharge at both the North and South structures.

Ammonia, pH, E.Coli, Cyanide, and Lead

Ammonia, measured as Nitrogen, is well below the maximum limit as set for the discharge of the Wastewater Treatment Plant. Showing an average of 0.6 mg/L in all areas of the stream as well as the CSO discharge, this would be considered highly acceptable plant effluent in this respect. The NPDES Permit Limit for Ammonia-Nitrogen is 1.5 and 3.0 mg/L for Summer and Winter respectively.

pH and E.Coli

The CSO discharge stream displayed results for both parameters that are well below the limits set forth in the NPDES Permit for Treatment Plant Effluent. pH limits are to be

between 6.0 and 9.0 standard units. Neither of the CSO discharge streams were below 7.0 or above 8.3. The samples taken upstream from the point of discharge at both the North and South CSO structures displayed a greater range of pH fluctuation than the discharge stream itself. Likewise the analysis for E. Coli was no greater than 4.5 colonies per 100 ml. The NPDES Limit for the same parameter pertaining to the discharge from the Wastewater Plant is 125 colonies per 100 ml. Compare this figure to the North CSO Dry Weather Results Upstream which was 420 colonies per 100 ml and the North CSO Wet Weather Results Upstream which was 2,093 colonies per 100 ml. All the E.Coli results from the South CSO monitoring points were less than those assigned to the Wastewater Plants Effluent.

Cyanide and Lead

Cyanide and Lead concentrations measured throughout the stream showed no influence from any contributing dischargers. The results were < 0.003 and no greater than 0.013 mg/L for cyanide and lead respectively. The Maximum Contaminant Levels set for drinking water are 0.2 and 0.015 mg/ L for the same pollutants.

In summary regarding the previously illustrated pollutant parameters, the discharge from the City's CSO has little or no significant impact on the receiving stream or the degradation thereof.

Precipitation Amounts,CSO Events, Discharge Volume, and Duration

A data sheet displaying precipitation amounts, overflow volumes and duration can be viewed in the section on CSO Event Data. The following is a summary of the data found in that section. Much of this summary can like wise be viewed in the section CSO Study Statistics. The recorded precipitation amounts used for this report spanned a 3 year period. Data was recorded from February ,1998 through November,2000. During that time there were 50 recorded and reported CSO events from the North Structure and 48 events from the South Structure. This yields a calculated average of 16.7 and 16.0 events per year respectively. Both CSO structures averaged 18+ million gallons per event. The

maximum discharge for one event was 210 million gallons at the North Structure and 302 million gallons at the South Structure. These volumes were recorded in February 1998. Since that time the CSO structures have undergone improvement in both structural improvements and operating procedures. As can be noted on the charts, Rainfall vs. Volume, in the last two and one-half years the maximum discharge has significantly decreased due to the above mentioned construction rehabilitation and improved management strategies. Couple this with the no significant impact found pertaining to the discharged pollutants in a CSO discharge stream and there is an indication of a properly managed CSO program.

Comparing the precipitation intensity of the three (3) sampled overflow events also shows evidence in favor of no significant impact. This is illustrated by the fact that an average rainfall amount causing and overflow is 1.78 inches at the North CSO and 1.94 at the South CSO. The 3 events sampled were 1.80, 1.35, and 1.34 inches respectively. Therefore one might expect to find even less stream dilution during the sampled events that would be for an average event.

Stream Reach Characterization and Evaluation Study and Report

Conclusions and Recommendations

As noted in the previous topics, regarding the summation of the collected data during the past 3 years, little or no significant impact on the receiving stream has been realized due to CSO discharges. The records and data presented in this report show a growing improvement in wet weather management practices by the City of Boonville. The rehabilitation of the CSO structures have enabled them to maximize their holding potentials, thereby pumping more water to the Wastewater Treatment Plant and allowing less to overflow to the receiving stream. At worst the water that does overflow to the creek is by-in-large rainwater that contains very little in the way of harmful pollutants. The First Flush has already been held captive and pumped to the wastewater treatment plant. At present the existing wastewater plant is designed for 1.4 MGD with a peak of 2.1 MGD. Within 2 years the City of Boonville will have contracted and constructed a new wastewater plant. The new facility will have a design capability of 2.9 MGD with a peak capacity of 5.0 MGD. This will allow the existing CSO structures to be maximized to their fullest potential. Overflows to the receiving stream will only occur in the event of an extremely heavy amount of precipitation.The number of overflow events occurring the passed 3 years averaged approximately 16 events per year at each structure. The construction of the new facility should decrease that number to 8 or less per year. Early flush of concentrated system pollutants will be easily handled and pumped to the wastewater plant. Any residual volumes will be in a highly diluted state and present no significant impact on the stream. Of course the City of Boonville will continue to eliminate unnecessary Inflow and Infiltration(I & I) from the Sanitary Sewer System (SSS) as well as diverting as much storm water as possible from the Combined Sewer System (CSS) and rerouting it as can reasonably be done. At this time a recommendation of Continue as Presently Done, would be prudent. CSO overflows should be monitored and the structures

operated at maximum efficiency. Timely reporting of all overflow events to the proper state authority should also be diligently continued as per IDEM's schedule of compliance.

North CSO Event # 1

Precipitation 1.50 inch

Baseline- Upstream Dry Weather Flow Results

May 08, 2000

Total Flow	Duration	BOD	TSS	pH (s.u.)	NH3-N	Cyanide	Lead	D.O.	E. Coli
MGD	Hours	Mg/L	Mg/L	1 ea.	Mg/L	Mg/L	Mg/L	Mg/L	co/100 ml
no data available	n.d.a.	< 5.0	38	7.88	0.57	< 0.003	< 0.002	n.d.a.	420

Upstream- CSO Overflow Event Sample Results

August 24, 2000

Total Flow	Duration	BOD	TSS	pH (s.u.)	NH3-N	Cyanide	Lead	D.O.	E. Coli
MGD	Hours	Mg/L	Mg/L	Max/ Min	Mg/L	Mg/L	Mg/L	Mg/L	co/100 ml
no data available	27	< 5.0	80	7.7/ 6.5	0.32	< 0.003	< 0.002	6.3	2,093

Discharge- CSO Overflow Event Sample Results

August 24, 2000

Total Flow	Duration	BOD	TSS	pH (s.u.)	NH3-N	Cyanide	Lead	D.O.	E. Coli
MGD	Hours	Mg/L	Mg/L	Max/ Min	Mg/L	Mg/L	Mg/L	Mg/L	co/100 ml
8.44	27	5.5	71	8.0/ 7.4	0.56	< 0.003	0.012	6.1	< 4.5

Downstream-CSO Overflow Event Sample Results

August 24, 2000

Total Flow	Duration	BOD	TSS	pH (s.u.)	NH3-N	Cyanide	Lead	D.O.	E. Coli
MGD	Hours	Mg/L	Mg/L	Max/ Min	Mg/L	Mg/L	Mg/L	Mg/L	co/100 ml
no data available	27	< 5.0	119	8.3/ 7.6	0.44	< 0.003	0.011	5.8	< 3.6

NORTH CSO EVENT # 2

Precipitation .35 Inch

BASELINE- UPSTREAM DRY WEATHER FLOW RESULTS

May 08, 2000

TOTAL FLOW	DURATION	BOD	TSS	pH (S.U.)	NH3-N	CYANIDE	LEAD	D.O.	E. COLI
MGD	HOURS	MG/L	MG/L	1 EA.	MG/L	MG/L	MG/L	MG/L	CO/100 ML
no data available	n.d.a.	< 5.0	38	7.88	0.57	< 0.003	< 0.002	n.d.a.	420

UPSTREAM- CSO OVERFLOW EVENT SAMPLE RESULTS

Sept. 25,2000

TOTAL FLOW	DURATION	BOD	TSS	pH (S.U.)	NH3-N	CYANIDE	LEAD	D.O.	E. COLI
MGD	HOURS	MG/L	MG/L	MAX/ MIN	MG/L	MG/L	MG/L	MG/L	CO/100 ML
no data avaliable	n.d.a.	< 5	111	8.8/ 7.2	0.13	< 0.003	< 0.002	7.5	2

DISCHARGE- CSO OVERFLOW EVENT SAMPLE RESULTS

Sept. 25, 2000

TOTAL FLOW	DURATION	BOD	TSS	pH (S.U.)	NH3-N	CYANIDE	LEAD	D.O.	E. COLI
MGD	HOURS	MG/L	MG/L	MAX/ MIN	MG/L	MG/L	MG/L	MG/L	CO/100 ML
no data avaliable	n.d.a.	< 6	83	8.2/ 7.3	0.59	< 0.003	0.010	5.7	< 1

DOWNSTREAM-CSO OVERFLOW EVENT SAMPLE RESULTS

Sept. 25 2000

TOTAL FLOW	DURATION	BOD	TSS	pH (S.U.)	NH3-N	CYANIDE	LEAD	D.O.	E. COLI
MGD	HOURS	MG/L	MG/L	MAX/ MIN	MG/L	MG/L	MG/L	MG/L	CO/100 ML
no data avaliable	n.d.a.	< 5	188	8.0/ 7.8	0.53	< 0.003	0.010	6.7	< 1

North CSO Event # 3

Precipitation 1.34 inch

Baseline- Upstream Dry Weather Flow Results

May 08, 2000

Total Flow	Duration	BOD	TSS	pH (s.u.)	NH3-N	Cyanide	Lead	D.O.	E. Coli
MGD	Hours	Mg/L	Mg/L	1 ea.	Mg/L	Mg/L	Mg/L	Mg/L	co/100 ml
no data available	n.d.a.	< 5.0	38	7.88	0.57	< 0.003	< 0.002	n.d.a.	420

Upstream- CSO Overflow Event Sample Results

Nov. 9, 2000

Total Flow	Duration	BOD	TSS	pH (s.u.)	NH3-N	Cyanide	Lead	D.O.	E. Coli
MGD	Hours	Mg/L	Mg/L	Max/ Min	Mg/L	Mg/L	Mg/L	Mg/L	co/100 ml
no data available	n.d.a.	< 5.0	73	7.2/ 6.9	0.26	0.02	< 0.001	7.0	0

Discharge- CSO Overflow Event Sample Results

Nov. 9, 2000

Total Flow	Duration	BOD	TSS	pH (s.u.)	NH3-N	Cyanide	Lead	D.O.	E. Coli
MGD	Hours	Mg/L	Mg/L	Max/ Min	Mg/L	Mg/L	Mg/L	Mg/L	co/100 ml
11.636	55	n.d.a.	n.d.a.	n.d.a.	n.d.a.	n.d.a.	n.d.a.	n.d.a.	n.d.a.

Downstream-CSO Overflow Event Sample Results

Nov. 9, 2000

Total Flow	Duration	BOD	TSS	pH (s.u.)	NH3-N	Cyanide	Lead	D.O.	E. Coli
MGD	Hours	Mg/L	Mg/L	Max/ Min	Mg/L	Mg/L	Mg/L	Mg/L	co/100 ml
no data available	n.d.a.	10.8	70	7.7/ 7.2	0.68	0.02	0.006	7.7	0

SOUTH CSO EVENT # 1

Precipitation 1.80 inch

BASELINE- UPSTREAM DRY WEATHER FLOW RESULTS

May 08, 2000

TOTAL FLOW	DURATION	BOD	TSS	pH (S.U.)	NH3-N	CYANIDE	LEAD	D.O.	E. COLI
MGD	HOURS	MG/L	MG/L	1 EA.	MG/L	MG/L	MG/L	MG/L	CO/100 ML
no data available	n.d.a	< 5.0	42	7.99	0.57	< 0.003	< 0.002	n.d.a.	85

UPSTREAM- CSO OVERFLOW EVENT SAMPLE RESULTS

Aug. 24, 2000

TOTAL FLOW	DURATION	BOD	TSS	pH (S.U.)	NH3-N	CYANIDE	LEAD	D.O.	E. COLI
MGD	HOURS	MG/L	MG/L	MAX/ MIN	MG/L	MG/L	MG/L	MG/L	CO/100 ML
no data available	25	< 5.0	119	8.3/ 7.6	0.44	< 0.003	0.011	5.8	< 3.6

DISCHARGE- CSO OVERFLOW EVENT SAMPLE RESULTS

Aug. 24, 2000

TOTAL FLOW	DURATION	BOD	TSS	pH (S.U.)	NH3-N	CYANIDE	LEAD	D.O.	E. COLI
MGD	HOURS	MG/L	MG/L	MAX/ MIN	MG/L	MG/L	MG/L	MG/L	CO/100 ML
10.64	25	< 6.0	63	7.5/ 7.4	0.66	< 0.003	0.013	5.6	< 1.0

DOWNSTREAM-CSO OVERFLOW EVENT SAMPLE RESULTS

Aug. 24, 2000

TOTAL FLOW	DURATION	BOD	TSS	pH (S.U.)	NH3-N	CYANIDE	LEAD	D.O.	E. COLI
MGD	HOURS	MG/L	MG/L	MAX/ MIN	MG/L	MG/L	MG/L	MG/L	CO/100 ML
no data available	25	< 5.0	145	7.6/ 7.2	0.50	< 0.003	0.010	5.7	< 1.0

SOUTH CSO EVENT # 2

Precipitation 1.35 inch

BASELINE- UPSTREAM DRY WEATHER FLOW RESULTS

May 08, 2000

TOTAL FLOW	DURATION	BOD	TSS	pH (S.U.)	NH3-N	CYANIDE	LEAD	D.O.	E. COLI
MGD	HOURS	MG/L	MG/L	1 EA.	MG/L	MG/L	MG/L	MG/L	CO/100 ML
no data available	n.d.a	< 5.0	42	7.99	0.57	< 0.003	< 0.002	n.d.a.	85

UPSTREAM- CSO OVERFLOW EVENT SAMPLE RESULTS

Sept. 25, 2000

TOTAL FLOW	DURATION	BOD	TSS	pH (S.U.)	NH3-N	CYANIDE	LEAD	D.O.	E. COLI
MGD	HOURS	MG/L	MG/L	MAX/ MIN	MG/L	MG/L	MG/L	MG/L	CO/100 ML
no data available	n.d.a	< 5	188	8.0/ 7.8	0.53	< 0.003	0.010	6.7	< 1

DISCHARGE- CSO OVERFLOW EVENT SAMPLE RESULTS

Sept. 25, 2000

TOTAL FLOW	DURATION	BOD	TSS	pH (S.U.)	NH3-N	CYANIDE	LEAD	D.O.	E. COLI
MGD	HOURS	MG/L	MG/L	MAX/ MIN	MG/L	MG/L	MG/L	MG/L	CO/100 ML
no data available	n.d.a.	< 5.5	49	9.3/ 7.4	0.78	< 0.003	0.011	6.1	< 1

DOWNSTREAM-CSO OVERFLOW EVENT SAMPLE RESULTS

Sept. 25, 2000

TOTAL FLOW	DURATION	BOD	TSS	pH (S.U.)	NH3-N	CYANIDE	LEAD	D.O.	E. COLI
MGD	HOURS	MG/L	MG/L	MAX/ MIN	MG/L	MG/L	MG/L	MG/L	CO/100 ML
no data available	n.d.a	< 5	420	8.2/ 7.4	0.36	< 0.003	0.010	6.7	< 5

SOUTH CSO EVENT # 3

Precipitation 1.34 inch

BASELINE- UPSTREAM DRY WEATHER FLOW RESULTS

May 08, 2000

TOTAL FLOW	DURATION	BOD	TSS	pH (S.U.)	NH3-N	CYANIDE	LEAD	D.O.	E. COLI
MGD	HOURS	MG/L	MG/L	1 EA.	MG/L	MG/L	MG/L	MG/L	CO/100 ML
no data available	n.d.a	< 5.0	42	7.99	0.57	< 0.003	< 0.002	n.d.a.	85

UPSTREAM- CSO OVERFLOW EVENT SAMPLE RESULTS

Nov. 9, 2000

TOTAL FLOW	DURATION	BOD	TSS	pH (S.U.)	NH3-N	CYANIDE	LEAD	D.O.	E. COLI
MGD	HOURS	MG/L	MG/L	MAX/ MIN	MG/L	MG/L	MG/L	MG/L	CO/100 ML
no data available	n.d.a	11	70	7.7/ 7.2	0.68	0.02	0.006	7.7	0

DISCHARGE- CSO OVERFLOW EVENT SAMPLE RESULTS

Nov. 9, 2000

TOTAL FLOW	DURATION	BOD	TSS	pH (S.U.)	NH3-N	CYANIDE	LEAD	D.O.	E. COLI
MGD	HOURS	MG/L	MG/L	MAX/ MIN	MG/L	MG/L	MG/L	MG/L	CO/100 ML
8.157	36	n.d.a.	n.d.a.	n.d.a.	n.d.a.	n.d.a.	n.d.a.	n.d.a.	n.d.a.

DOWNSTREAM-CSO OVERFLOW EVENT SAMPLE RESULTS

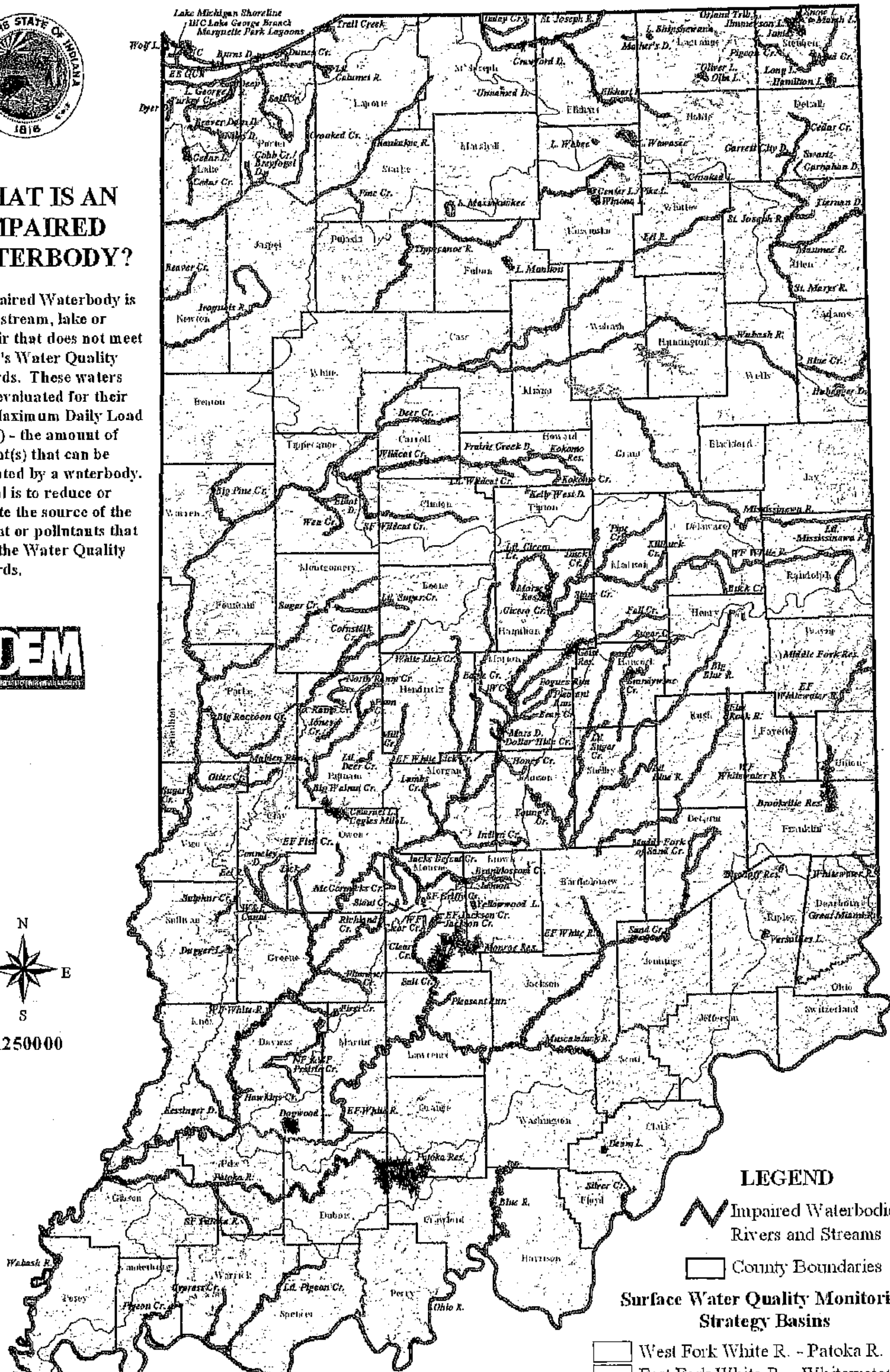
Nov. 9, 2000

TOTAL FLOW	DURATION	BOD	TSS	pH (S.U.)	NH3-N	CYANIDE	LEAD	D.O.	E. COLI
MGD	HOURS	MG/L	MG/L	MAX/ MIN	MG/L	MG/L	MG/L	MG/L	CO/100 ML
no data available	n.d.a	9	182	7.4/ 6.1	0.48	0.02	0.011	7.9	0

1998 303(d) List of Impaired Waterbodies

WHAT IS AN IMPAIRED WATERBODY?

An Impaired Waterbody is a river, stream, lake or reservoir that does not meet Indiana's Water Quality Standards. These waters will be evaluated for their Total Maximum Daily Load (TMDL) - the amount of pollutant(s) that can be assimilated by a waterbody. The goal is to reduce or eliminate the source of the pollutant or pollutants that violate the Water Quality Standards.



N
W E
S

1:1250000

20 0 20 40 Miles

LEGEND

Impaired Waterbodies

Rivers and Streams

County Boundaries

Surface Water Quality Monitoring Strategy Basins

West Fork White R. - Patoka R.

East Fork White R - Whitewater R.

Upper Wabash River

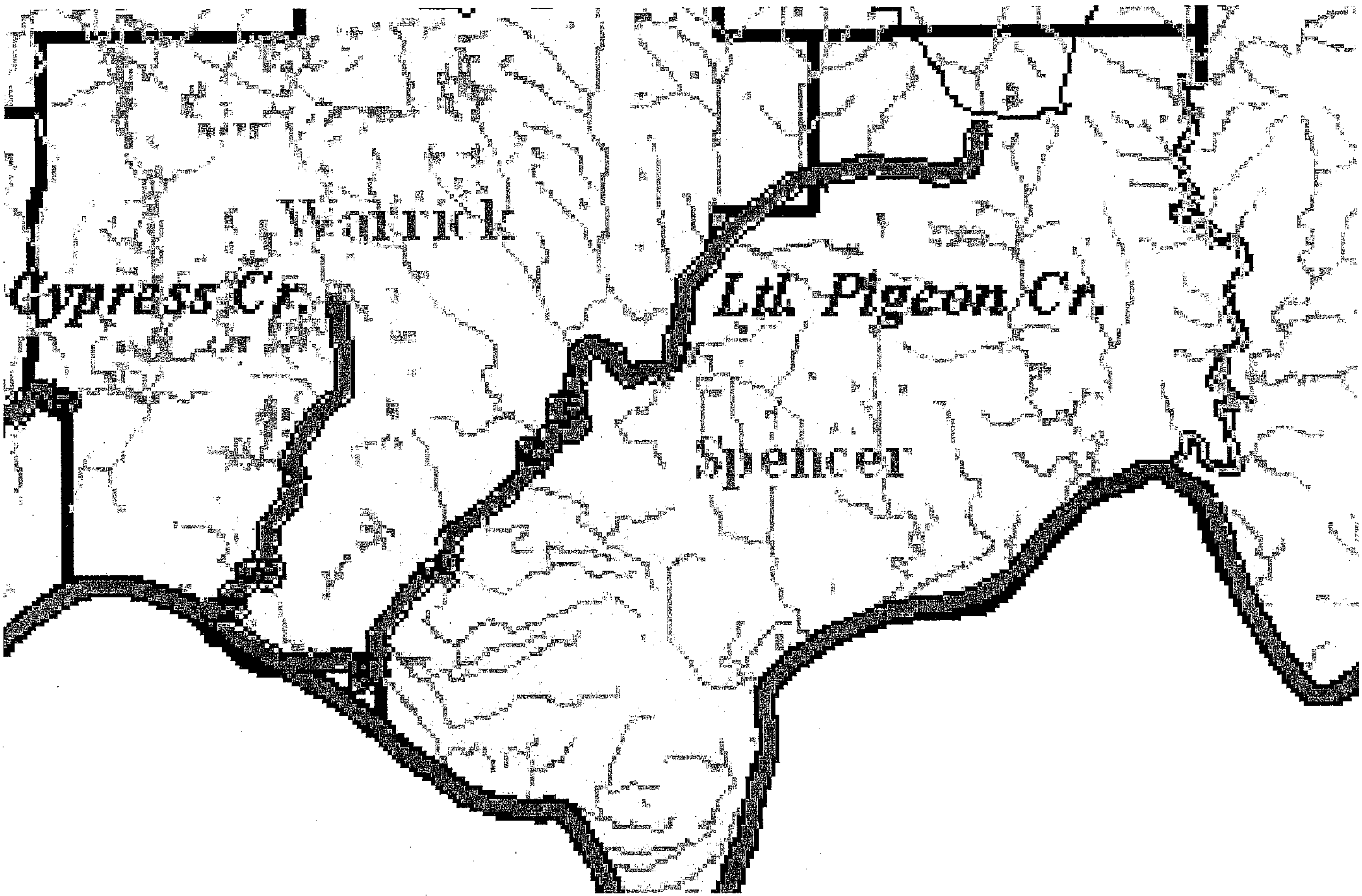
Lower Wabash R. - Kankakee R.

Great Lakes - Ohio River

INDIANA DEPARTMENT OF ENVIRONMENTAL MANAGEMENT

OFFICE OF WATER MANAGEMENT ASSESSMENT BRANCH

Prepared and Printed: 09/06/00 JWOOD


Warrick
Cypress Cr.
Ltl. Pigeon Cr.
Spencer

1998 303(d) List of Impaired Waterbodies with 15 Year Schedule (original order)***

Orginal 303(d) #	Water Body	Location/Reach	County	Major Basin	Parameter(s) of Concern	Severity Ranking	HUC	Subwatershed (s)	Targete
1	Beaver Dam Ditch	Crown Point	Lake	Lake Michigan Basin	Impaired Biotic Communities	Medium	04040001	030	2005-2007
2	Burns Ditch	Lake Station to Portage	Porter	Lake Michigan Basin	FCA1 for PCB2 & Hg3; Pesticides; Lead; E. coli; Impaired Biotic Communities	High	04040001	040 050	2000-2004* 2005-2007** 2010-2012**
3	Crawford Ditch	Elkhart	Elkhart	Lake Michigan Basin	Copper; Oil	Medium	04050001	300	2000-2004
4	Crooked Lake	Burr Oak	Noble / Whitley	Wabash River Basin	FCA for Hg	Low	05120106	010	2008-2010
5	Deep River	Hobart	Lake	Lake Michigan Basin	Impaired Biotic Communities	Medium	04040001	030	2005-2007
6	Dunes Creek	Tremont	Porter	Lake Michigan Basin	Impaired Biotic Communities	Medium	04040001	140	2005-2007
7	Elkhart River	All	Elkhart	Lake Michigan Basin	FCA for PCB & Hg; E. coli	Medium	04050001	200 220	2000-2004* 2010-2012**
8	Grand Calumet River (East Branch)	Gary to East Chicago	Lake	Lake Michigan Basin	FCA for PCB & Hg; Cyanide; Lead; Oil and Grease; Pesticides: Copper; Impaired Biotic Communities	High	04040001	020	1998-2000
9	Grand Calumet River (West Branch)	East Chicago to Hammond	Lake	Lake Michigan Basin	FCA for PCB & Hg; Ammonia; D.O.; Cyanide; Lead; Pesticides; Chlorides; Impaired Biotic Communities	High	04040001	020	1998-2000

199	Blue River	All	Harrison	Ohio River Basin	FCA for PCB & Hg	Medium	05140104	140	2010-2012
200	Cypress Creek	Booneville	Warrick	Ohio River Basin	Chlordane	Medium	05140201	280	2000-2004
201	Deam Lake	New Providence	Clark	Ohio River Basin	FCA for Hg	Low	05140101	270	2010-2012
202	Little Pigeon Creek	Dale	Spencer	Ohio River Basin	D.O., Ammonia	Medium	05140201	260 270	2000-2004
203	Ohio River	New Albany, Jeffersonville	Clark / Floyd	Ohio River Basin	FCA for PCB; Lead; E. coli	Medium	05	NA	2000-2004* 2010-2012***
204	Ohio River	Evansville	Vanderburgh	Ohio River Basin	FCA for PCB; Lead; E. coli	Medium	05	NA	2000-2004* 2010-2012***
205	Ohio River	Entire Length	Dearborn / Ohio / Switzerland / Jefferson / Clark / Floyd / Harrison / Crawford / Perry / Spencer / Warrick / Vanderburg / Posey	Ohio River Basin	FCA for PCB; E. coli	Medium	05	NA	2000-2004* 2010-2012***
206	Pigeon Creek	Evansville	Vanderburgh	Ohio River Basin	FCA for PCB; Organics; Chlordane	High	05140202	050 060	2000-2004* 2010-2012***
207	Silver Creek	New Albany	Floyd	Ohio River Basin	FCA for PCB & Hg	Medium	05140101	280	2010-2012
208	Versailles Lake	Versailles	Ripley	Ohio River Basin	FCA for Hg	Low	05090203	110	2010-2012

[1]FCA - Fish Consumption Advisory

[2]PCB - Polychlorinated Biphenyls

[3]Hg - Mercury

[4]D.O. - Dissolved Oxygen

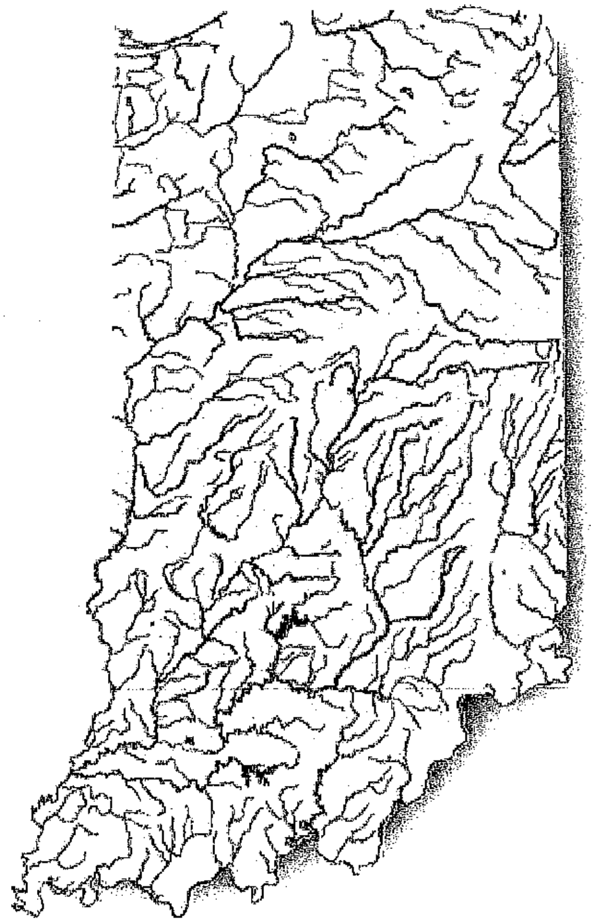
***Only waters for which fish tissue data support issuance of fish consumption advisories are individually cited above. The Indiana Department of Health has issued a general fish consumption advisory for all other waters of the state. This advisory was based on extrapolation of the fish tissue data that were available and generally recommends that if no site-specific advisory is in place for a waterbody, the public should eat no more than one meal (8 oz.) per week of fish caught in these waters. Women of child bearing age, women who are breast feeding, and children up to 15 years of age should eat no more than one meal per month. The basis for this general advisory is widespread occurrence of mercury or PCBs (or both) in most fish sampled throughout the state. Please refer to the most recent Fish Consumption Advisory booklet available through the Indiana Department of Health (317/233-7808). Sources of the mercury and PCBs are unknown for the most part, but it is suspected that they result from air deposition in many cases. This could mean that the sources are located outside state and national boundaries. Assessment and control of these pollutants may therefore require interstate and international measures which are beyond the scope of state environmental agencies. The 15 year schedule for TMDL development is subject to change.

Rivers and Streams

Indiana's Rivers and Streams

IDEM has assessed over 99 percent of Indiana's rivers and streams for the water's ability to support fish, shellfish, macroinvertebrates and other aquatic life. Water quality assessments for this cycle began in 1997 and were completed for the entire state in 2002. Sixty-four percent of the streams were found to fully support aquatic life. Of the 8660 stream miles surveyed for recreational use, about 59 percent were found to support swimming and boating. *E. coli* bacteria indicated unsafe recreational levels in over 3500 stream miles.

Indiana's Impaired Rivers and Lakes (1998 List)
Source: 1998 303d Report



Indiana's Impaired Rivers and Lakes

The map titled "Indiana's Impaired Rivers and Lakes" indicates Indiana's impaired rivers and lakes. The impaired rivers and lakes, in red, do not meet Indiana's water quality standards for designated uses or other natural resource goals, such as aquatic life support, fish consumption and recreational use. For more information about Indiana's impaired rivers and lakes, visit the TMDL - 303(d) List Web site for 2002 updates.

For more information about Indiana's river and stream assessments, visit IDEM's Water Quality (305(b)) Web site.

State Form 4336

DEPARTMENT OF ENVIRONMENTAL MANAGEMENT

INDIANAPOLIS

OFFICE MEMORANDUM

Date: November 6, 2002

To: Interested Parties

From: Mary Ellen Gray
Deputy Assistant Commissioner
Office of Water Quality

Subject: Final draft of 2002 303(d) list and supporting materials

The Federal Clean Water Act, Section 303(d) and 305(b) requires each state to identify those waters that do not meet the state's water quality standards for designated uses and provide information on the state's water quality. These reporting requirements are known respectively as the 303(d) list and the 305(b) report. Historically, these reports have been separate. However, for this listing cycle, the U.S. Environmental Protection Agency (EPA) developed a guidance document that recommends the states to integrate their reporting on these requirements.

Indiana has opted to utilize this integrated report which includes a consolidated listing methodology. This integrated report allows the state to coordinate the reporting of the 303(d) and 305(b) and to categorize those waterbodies not meeting water quality standards based on the different situations relevant to their support of designated uses.

Indiana has already submitted the 305(b) component of this integrated report, which is available at www.in.gov/idem/water/planbr/wqs/quality.html.

The enclosed material comprises the 303(d) list component. The 303(d) list material includes:

- 303(d) Listing Explanations
- IDEM 303(d) list methodology
- Response to comments on Indiana's 2002 303(d) draft list of impaired waters
- 303(d) List Category 2
- 303(d) List Category 3

- 303(d) List Category 4A
- 303(d) List Category 4B
- 303(d) List Category 4C
- 303(d) List Category 5 – list of impaired waters arranged by TMDL schedule
- 303(d) List Category 5 – list of impaired waters arranged by 1998 303(d) list number and including database stream segment designations and Hydrologic Unit Code

IDEM received a number of comments on the 2002 303(d) draft published in March of this year. IDEM very much appreciates the comments we received and we have tried to be as responsive as possible. The public comments and IDEM's responses are in the response to comment document. The following address the key comments raised:

- ***The Water Pollution Control Board (WPCB) has not yet adopted a 303d listing methodology as required in SEA 431*** SEA 431 requires that the list be published in the Indiana Register and be made available to the WPCB and for public comment before submission to EPA. SEA 431 did not require that a rulemaking be completed before the 2002 303(d) list was developed. A timeline was not attached to this component of SEA 431 because it was recognized that the rulemaking procedures are lengthy and such a rulemaking should not be rushed. The EPA has delayed the completion of their TMDL regulation, originally expected at the end of 2000. A state rule will have to comply with the federal rule, which is now expected in the next several months. IDEM has developed a listing methodology (enclosed) that describes the listing procedures that IDEM followed. In addition this listing includes recommendations from the statutorily required TMDL Advisory Group.

- ***Inclusion of impaired biological communities on the 303(d) list.*** IDEM believes that there is adequate information to include a number of waterbodies as impaired biological communities on the 303(d) list. A waterbody is considered to be impaired, if it does not meet a designated use(s). These impairments are based on the water quality standards promulgated by Indiana for a pollutant. Listings of impaired biotic communities are based on the narrative standard for aquatic life. IDEM does not list streams where the impairment is solely due to habitat issues, or where the impairment is caused by pollution rather that a pollutant. IDEM also realizes that protocols for these TMDLs still need to be developed. As a result these TMDLs will be phased in over the 15 year schedule to allow time for IDEM and others to develop these protocols.

- ***Inclusion of fish consumption advisories on the 303(d) list.*** IDEM has included fish consumption advisories (FCA) on the 303(d) list. All waterbodies that are on the 303(d) list for FCA have actual data associated with it. "Fishable" is a designated use to protect human health. The FCA, is not based on a narrative water quality standard but rather, it is based on a risk analysis for the protection of human health. This risk analysis is derived from a numeric threshold for the presence of contaminants in fish tissue. Consumption of such contaminated fish by humans is considered unsafe for

human health and constitutes the basis for fish consumption advisories. IDEM feels it is appropriate to include these waterbodies on the 303(d) list in order to be protective of human health. IDEM also realizes that protocols for these TMDLs still need to be developed. As a result these TMDLs will be placed at the back of the 15 year schedule to allow time for protocols to be developed.

- ***Deference to CSO LTCPs for e-coli.*** IDEM has included waterbodies that are impaired for e.coli that are proximate to Combined Sewer Overflow (CSO) communities. IDEM has done so because there is no indication that these streams listed for E. coli are impaired solely due to CSO issues or other urban storm water run-off. For these waterbodies, the TMDLs have been placed further back in the 15 year schedule in order to give the CSO long-term control plan time to have a positive impact on water quality.

- ***Data used for the 303(d) list and its availability to review during the comment period.*** Waterbodies are included on Indiana's 2002 303(d) list only if actual data exists showing an impairment within a waterbody or assessment unit as defined by EPA and described in the enclosed methodology. Projected data, modeling, and/or subjective evaluations such as cursory visual inspections were not used for 303(d) listing purposes. IDEM has now made available upon request the data used to support the inclusion of waterbodies on the list and will continue to be responsive to information requests. It is IDEM's goal to have all of this data centrally and electronically available. However, it will take some time for IDEM to meet this goal.

- ***Scheduling of TMDLs and our interest in working with stakeholders on 'streamlining' and involving the public.*** While specific situations may vary, the TMDL process in general can be a lengthy and complicated. With 428 TMDLs scheduled, IDEM will be working with EPA, the public and other states to explore all options to expedite and streamline the TMDL process or to substitute other effective approaches for TMDLs. IDEM also will continue to work with the TMDL advisory group to explore ways to streamline the process and continually improve upon public involvement.

Category 5 comprises the 2002 303(d) list. Category 5 has a total number of 428 waterbodies. The breakdown of the Category 5 listing by parameters is as follows:

List 5 – 428 waterbodies*

Parameter	Number of waterbodies on 303(d) list
Impaired Biotic Communities	180
E. coli	74
FCA	167
DO	27
Nutrients	22
Total Dissolved Solids	19

Algae	14
Sulfates	12
Taste & Odor	10
Ammonia	7
Cyanide	6
Chlorides	5
pH	5
Copper	3
Lead	3
Oil & Grease	2
Dioxin	1
Nickel	1
Nitrates	1
Siltation	1
Zinc	1

*For 303(d) waterbodies with more than one segment, each parameter was only counted once.

Category 2 – 960 waterbody segments

Category 3 – 688 waterbody segments

Category 4A – 2 waterbody segments

Parameter	**Number of waterbodies**
Ammonia, DO	1

Category 4B – 9 waterbody segments

Parameter	**Number of waterbodies**
Thermal	3
DO	2
E. coli	1

Category 4C – 16 waterbody segments

Parameter	**Number of waterbodies**
Impaired Biotic Communities	14

While the delisting methodology is more fully described in the enclosed methodology, IDEM has proposed to EPA that a 35 waterbodies be delisted from the 1998 list because new data has indicated that these waterbodies are no longer impaired. The breakdown of the listing by parameters is as follows:

Parameter	Number of waterbodies
Cyanide	12
Dissolved Oxygen	11
Lead	7
Ammonia	5
Copper	2
E.Coli	2
PH	2
Pesticides	2
Chlordane	1
Endrin	1
Oil and Grease	1

Currently there is a requirement to submit the 303(d) to EPA every two years. At the writing of this memo it is IDEM's understanding that the new EPA TMDL rule (Watershed rule) will include a provision for 303(d) list submittal every four years. This rule is expected to be promulgated shortly.

IDEM will host a public meeting at 1:30 PM on November 13, 2002, at the Indiana Government Ceuter South, 402 W. Washington Street, Indianapolis, Conference Room C, to present these materials and answer questions. These materials will then be presented to the Water Pollution Control Board at its regularly scheduled meeting on December 11, 2002, at 1:30 PM at the Indiana Government Center South, Conference Room C. Upon that review, these materials will be submitted to EPA.

We hope that you find these materials informative. Please let me know if you have any questions or concerns. My email is mgray@dem.state.in.us and my phone is (317) 233-2550.

Water Quality Assessment Decisions And Listing of Waterbodies by Categories Using EPA 2002 Consolidated Methodology

(October 2002)

For the development of 2002 303(d) List of Impaired Waterbodies, Indiana has used a consolidated methodology as outlined in the November 2001 U.S. EPA "2002 Integrated Water Quality Monitoring and Assessment Report Guidance". According to this methodology, each waterbody is placed in one of five categories depending on the degree to which it supports designated uses for full body contact recreation, and for protection of aquatic life, wildlife or human health. The actual 303(d) list of Impaired waterbodies that requires TMDLs development is included in Category 5. The primary data source and information for the 303(d) list in Category 5 and for the 4 other Categories is the IDEM's database for the 305(b) Water Quality Assessment Report. A complete discussion on 303(d) listing and consolidated listing methodology for the waterbodies by categories is described in the IDEM's document entitled "Indiana's 303(d) Listing Methodology for Impaired Waterbodies and Total Maximum Daily Load-September 2002". A brief description and explanation for listing of waterbodies by each category is as follows:

Description and Explanation for Listing of Waterbodies by Categories:

Category 1: **Waterbodies that are attaining Water Quality Standards and No Designated Use is Threatened**

IDEM has no waterbodies listed in this category.

IDEM has extensively sampled the surface water resource in Indiana, but has not sampled any one stream for all the designated uses. IDEM, therefore, has no waterbodies or waterbody segments listed in this category.

Category 2: **Waterbodies Attaining Some Designated Uses, but have No or Insufficient Data to Determine if Other Uses are Attained.**

This list is comprised of 960 waterbody segments that support some designated uses.

Category 3: **Waterbodies with Insufficient or No Data to Determine a Designated Use.**

This list is comprised of 688 waterbody segments for which water quality data or information is lacking or is insufficient to determine a designated use.

50 waterbodies and/or their associated waterbody segments from the draft 2002 303(d) list for the reasons described above have been moved and placed into this category. The list numbers for these waterbodies are:

List # 8, 9, 11, 12, 43, 53, 74, 93, 93, 93, 93, 97, 106, 206, 206, 206, 224, 279, 280, 281, 283, 285, 286, 287, 289, 299, 300, 302, 305, 307, 309, 322, 322, 322, 330, 331, 340, 341, 372, 373, 374, 375, 377, 380, 447, 459, 467, 472, 473 and 485.

Some of the waterbodies identified above may still remain on the 303(d) list Category 5 for one or more parameters that have sufficient data to prove that a designated use is not being attained and that the waterbody requires a TMDL.

Category 4: Waterbodies Impaired or Threatened for One or More Designated Uses.

4A Waterbodies for which TMDLs have been Developed and Approved by EPA.

This list is comprised of 1 waterbody (2 waterbody segments) with 2 parameters (List #372) for which TMDLs have been developed and approved by EPA Region 5.

4B Waterbodies Where Other Pollution Control Measures Could Result in Attainment Of the Water Quality Standards

- This list is comprised of 9 waterbodies. Six waterbodies and/or their segments (List #s 466, 466, 94, 94, 93 and 93) listed on the 1998 and the draft 2002 303(d) list for thermal impairments have been placed in this category.

- Three waterbodies and/or their segments (List #s 32, 351 and 379) from the 1998 and the draft 2002 303(d) list for organic enrichment, low dissolved oxygen and pathogens have been placed in this category.

- It is anticipated that other existing programs within IDEM could handle the water quality issues for the waterbodies listed in this category.

4C Water Quality Impairment is due to Pollution and Not Caused by a Pollutant.

This list is comprised of 16 waterbodies and/or waterbody segments ..
One waterbody (List # 293) listed on the draft 2002 303(d) list has been moved into this category.

Category 5: Waterbodies Impaired or Threatened for One or More Designated Uses by One or More Pollutants and Require TMDLs Development.

This list is now comprised of 427 versus 485 waterbodies in the draft 2002 303(d) list. All the impaired 427 waterbodies (or 1158 Waterbody segments) that require TMDLs development have been sorted by TMDL Development Schedule.

- Indiana's 2002 303(d) List of Impaired Waterbodies.
  List Sorted by TMDL Development Schedule (see Column 5)

- Indiana's 2002 303(d) List of Impaired Waterbodies.
  List of Database Stream Segment Designations ((see Column 1)

To the draft 2002 303(d) list changes were made to 21 waterbodies wherein additional parameters were added. Additionally, changes were made to 20 303(d) list numbers, and some editorial changes were made to 9 waterbodies. The draft 2002 303(d) list numbers, and the kind of changes made to them are identified below:

i. Draft 2002 303(d) list numbers to which additional parameters were added:

List # 4, 13, 16, 26, 36, 73, 75, 82, 90, 101, 102, 117, 135, 163, 166, 184, 184, 190, 194, 375 and 485.

ii. Draft 2002 303(d) list numbers that were changed:

List #	Changed to List #	List #	Changed to List #
70	69	354	192
90	190	358	356
90	190	359	356
249	250	360	356
253	251	362	356
256	255	370	166
260	258	372	173
277	47	388	387
352	172	437	423
353	190	478	167

iii. Draft 2002 303(d) list numbers to which editorial changes were made:

List # 5, 259, 339, 464, 470, 476, 477, 479 and 480.

De-Listing of Impaired Waterbodies:

Starting in 1998 to this date, IDEM has endeavored to sample, analyze and collect water quality data for a number of waterbodies listed on the 1998 303(d) List with the purpose to develop TMDLs. As part of this sampling and data collection effort, new data showed that many waterbodies, from one or more major river basins, were no longer impaired for one or more parameters and therefore could be de-listed from the 1998 303(d) List. It is estimated that 35 Waterbodies for 46 parameters will be de-listed from the 1998 303(d) List. A complete list of waterbodies with the respective 303(d) list numbers from several major river basins that will be de-listed from the 1998 303(d) list is provides in the attached table. However, some of these waterbodies will still remain on the 2002 303(d) list for other parameters that will not be de-listed.

(Continued on the next two pages)

List of Waterbodies and Parameters Recommended To Be De-Listed From 1998 303(d) List

Waterbody (WB)	303(d) List ID#	Major River Basin	Parameter(s)	Status
Big Blue River	164	EF. White River	Cyanide	New data supports de-listing
Cobb Creek / Breyfogel Ditch	53	Kankakee River	Dissolved Oxygen	New data supports de-listing
Pine Creek	58	Kankakee River	Dissolved Oxygen	New data supports de-listing
Burns Ditch	2	Lake Michigan	Pesticides, Lead	New data supports de-listing
Crawford Ditch	3	Lake Michigan	Copper, Oil & Grease	New data supports de-listing
Grand Calumet River (East Branch)	8	Lake Michigan	Lead, Copper	New data supports de-listing
Grand Calumet River (West Branch)	9	Lake Michigan	Lead, Dissolved Oxygen	New data supports de-listing
Indiana Harbor Canal (IHC)	11	Lake Michigan	Lead, Dissolved Oxygen	New data supports de-listing
Indiana Harbor Canal (Lake George Branch)	12	Lake Michigan	Dissolved Oxygen	New data supports de-listing
Little Calumet River	21	Lake Michigan	Cyanide, Pesticides	New data supports de-listing
Little Calumet River	23	Lake Michigan	Dissolved Oxygen	New data supports de-listing
Mather's Ditch	27	Lake Michigan	Endrin, Dissolved Oxygen	New data supports de-listing
Mud Creek	28	Lake Michigan	Ammonia	New data supports de-listing
St. Joseph River (portion from the Indiana Michigan border in Elkhart County to South Bend)	36	Lake Michigan	*E. Coli*	New data may support de-listing up to South Bend
Trail Creek	37	Lake Michigan	Cyanide	New data supports de-listing
Blue Creek	40	Maumee River	Dissolved Oxygen	New data supports de-listing
Garrett City Ditch	42	Maumee River	Ammonia	New data supports de-listing
Habegger Ditch	43	Maumee River	Ammonia	New data supports de-listing
Swartz-Carnahan Ditch	48	Maumee River	Dissolved Oxygen	New data supports de-listing
Tieman Ditch	49	Maumee River	Dissolved Oxygen	New Data supports de-listing
Cypress Creek	200	Ohio River	Chlordane	New data supports de-listing
Little Pigeon Creek	202	Ohio River	Ammonia	New data supports de-listing
Ohio River	203, 204	Ohio River	Lead	New data supports de-listing
Eel River	68	Wabash River	Cyanide	New data supports de-listing
Little Wildcat Creek/ Kelly West Ditch	78	Wabash River	Dissolved Oxygen	New data supports de-listing
Prairie Creek Ditch	83	Wabash River	Dissolved Oxygen	New data supports de-listing
South Fork Wildcat Creek	84	Wabash River	Cyanide	New data supports de-listing
Tippecanoe River	91	Wabash River	Cyanide	New data supports de-listing

List of Waterbodies and Parameters Recommended To Be De-Listed From 1998 303(d) List, (Cont'd.)

Waterbody (WB)	303(d) List ID#	Major River Basin	Parameter (s)	Status
Wabash River	95	Wabash River	Cyanide	New data supports de-listing
Wildcat Creek	97	Wabash River	Cyanide, Lead	New data supports de-listing
Cicero Creek	104	WF. White River	*E. Coli*	New data supports de-listing
Mars Ditch	132	WF. White River	pH, Cyanide	New data supports de-listing
State Ditch	144	WF. White River	pH, Cyanide	New data supports de-listing
West Fork White River	148	WF. White River	Dissolved Oxygen, Ammonia	New data supports de-listing
West Fork White River	152	WF. White River	Cyanide	New data supports de-listing
West Fork White River	155	WF. White River	Cyanide	New data supports de-listing
West Fork White River	160	WF. White River	Lead	New data supports de-listing
Total WBs =37			**Parameters (Total) = 48**	**37 WBs for 48 parameters will be de-listed**

Table 1: 2002 303(d) list for Indiana*

Parameters of Concern are abbreviated as follows: FCA, Fish Consumption Advisory; PCB, Polychlorinated biphenyls; Hg, Mercury; DO, Dissolved Oxygen; PAH, Polycyclic Aromatic Hydrocarbons

Waterbody Name	County	Major Basin	Parameter(s) of Concern	TMDL Development Schedule**	303(d) #
Grand Calumet River - Gary to Indiana Harbor Canal	Lake	GREAT LAKES	FCA for PCB & Hg; Cyanide, Oil and Grease; Pesicides; Impaired Biotic Communities; E. coli; Cadmium; Zinc; PAH	1998 - 2004	8
Grand Calumet River - headwaters	Lake	GREAT LAKES	FCA for PCB & Hg; Cyanide; Oil and Grease; Pesticides; Impaired Biotic Communities; Ammonia	1998 - 2004	8
Grand Calumet River - Illinois to Indiana Harbor Canal	Lake	GREAT LAKES	FCA for PCB & Hg, Amonia; Cyanide; Pesticides; Chlorides; Impaired Biotic Communities; Organics; PAH; Cadmium; Nickel; Zinc; Organic Enrichment; E. coli	1998 - 2004	9
INDIANA HARBOR	Lake	GREAT LAKES	FCA for PCB & Hg; Pesticides;	1998 - 2004	11
Indiana Harbor Canal main channel	Lake	GREAT LAKES	FCA for PCB & Hg; Pesticides; Metals; Lead; E. coli; PAH	1998 - 2004	11
Lake George Branch - IHC	Lake	GREAT LAKES	FCA for PCB & Hg; Oil and Grease; Pesticides; Impaired biotic Communities; Metals; E. coli; PAH	1998 - 2004	12
Deep River - Burns Ditch	Lake	GREAT LAKES	E. coli	2000 - 2004	5
LAKE MICHIGAN SHORELINE	Lake, Porter,LaPorte	GREAT LAKES	E. coli	2000 - 2004	17
LITTLE CALUMET RIVER	Porter, LaPorte	GREAT LAKES	E. coli	2000 - 2004	22
LITTLE CALUMET RIVER	Lake	UPPER ILLINOIS	Cyanide; Pesticides; DO	2000 - 2004	23
Burns Ditch	Lake	GREAT LAKES	Cyanide; E. coli; Pesticides	2000 - 2004	24
Little Calumet River	Lake	GREAT LAKES	Cyanide; E. coli	2000 - 2004	24
Beanblossom Creek	Brown, Monroe	WEST FORK WHITE	E. coli	2001 - 2005	100
Connelly Ditch	Clay	WEST FORK WHITE	E. coli	2001 - 2005	105

North Branch Otter Creek - Diamond Cr to mouth	Vigo	LOWER WABASH	Zinc	2009 - 2011	366
Carpenter Creek tributary	Jasper	UPPER ILLINOIS	Impaired Biotic Communities; Nutrients; DO	2009 - 2011	415
LAWRENCE LAKE	Marshall	UPPER ILLINOIS	Impaired Biotic Communities	2009 - 2011	435
MYERS LAKE	Marshall	UPPER ILLINOIS	Impaired Biotic Communities	2009 - 2011	436
TURTLE CREEK RESERVOIR	Sullivan	LOWER WABASH	Thermal	2009 - 2011	466
LITTLE KANKAKEE RIVER-MILL CREEK-FISH LAKES	LaPorte	UPPER ILLINOIS	Impaired Biotic Communities	2009 - 2011	485
BLUE RIVER	Harrison	OHIO TRIBUTARIES	E. coli	2010 - 2012	199
BLUE RIVER	Harrison	OHIO TRIBUTARIES	E. coli	2010 - 2012	199
BLUE RIVER	Harrison	OHIO TRIBUTARIES	Impaired Biotic Communities	2010 - 2012	199
CYPRESS CREEK	Warrick	OHIO TRIBUTARIES	Chlordane	2010 - 2012	200
CYPRESS CREEK	Warrick	OHIO TRIBUTARIES	Chlordane; Sulfates; Total Dissolved Solids; E. coli	2010 - 2012	200
CYPRESS CREEK	Warrick	OHIO TRIBUTARIES	Chlordane; Total Dissolved Solids; E. coli	2010 - 2012	200
LITTLE PIGEON CREEK	Spencer	OHIO TRIBUTARIES	Ammonia; Total Dissolved Solids	2010 - 2012	202
LITTLE PIGEON CREEK	Spencer	OHIO TRIBUTARIES	DO; Ammonia	2010 - 2012	202
LITTLE PIGEON CREEK	Spencer	OHIO TRIBUTARIES	E. coli	2010 - 2012	202
LITTLE PIGEON CREEK	Spencer	OHIO TRIBUTARIES	Impaired Biotic Communities; Sulfates; Total Dissolved Solids	2010 - 2012	202
LITTLE PIGEON CREEK	Spencer	OHIO TRIBUTARIES	Sulfates; Total Dissolved Solids	2010 - 2012	202
Ohio River	Clark, Floyd	OHIO RIVER	E. coli	2010 - 2012	203
Ohio River	Vanderburg	OHIO RIVER	E. coli	2010 - 2012	204
OHIO RIVER - McAlpine to Greenwood, KY	Dearborn, Ohio, Switzerland, Jefferson, Clark, Floyd, Harrison, Crawford, Perry, Spencer, Warrick, Vanderburg, Posey	OHIO RIVER	E. coli	2010 - 2012	205
PIGEON CREEK-HARPER DITCH	Vanderburg	OHIO TRIBUTARIES	DO	2010 - 2012	206
PIGEON CREEK-KLEYMEYER PARK	Vanderburg	OHIO TRIBUTARIES	E. coli	2010 - 2012	206

IAC 2-1-2 Maintenance of surface water quality standards

Authority: IC 13-14-8; IC 13-14-9; IC 13-18-3

Affected: IC 13-18-1; IC 13-18-4; IC 13-30-2-1

Sec. 2. The following policies of nondegradation are applicable to all surface waters of the state:

(1) For all waters of the state, existing beneficial uses shall be maintained and protected. No degradation of water quality shall be permitted which would interfere with or become injurious to existing and potential uses.

(2) All waters whose existing quality exceeds the standards established herein as of February 17, 1977, shall be maintained in their present high quality unless and until it is affirmatively demonstrated to the commissioner that limited degradation of such waters is justifiable on the basis of necessary economic or social factors and will not interfere with or become injurious to any beneficial uses made of, or presently possible, in such waters. In making a final determination under this subdivision, the commissioner shall give appropriate consideration to public participation and intergovernmental coordination.

(3) The following waters of high quality, as defined in subdivision (2), are designated by the board to be an outstanding state resource and shall be maintained in their present high quality without degradation:

(A) The Blue River in Washington, Crawford, and Harrison Counties, from river mile 57.0 to river mile 11.5.

(B) The North Fork of Wildcat Creek in Carroll and Tippecanoe Counties, from river mile 43.11 to river mile 4.82.

(C) The South Fork of Wildcat Creek in Tippecanoe County, from river mile 10.21 to river mile 0.00.

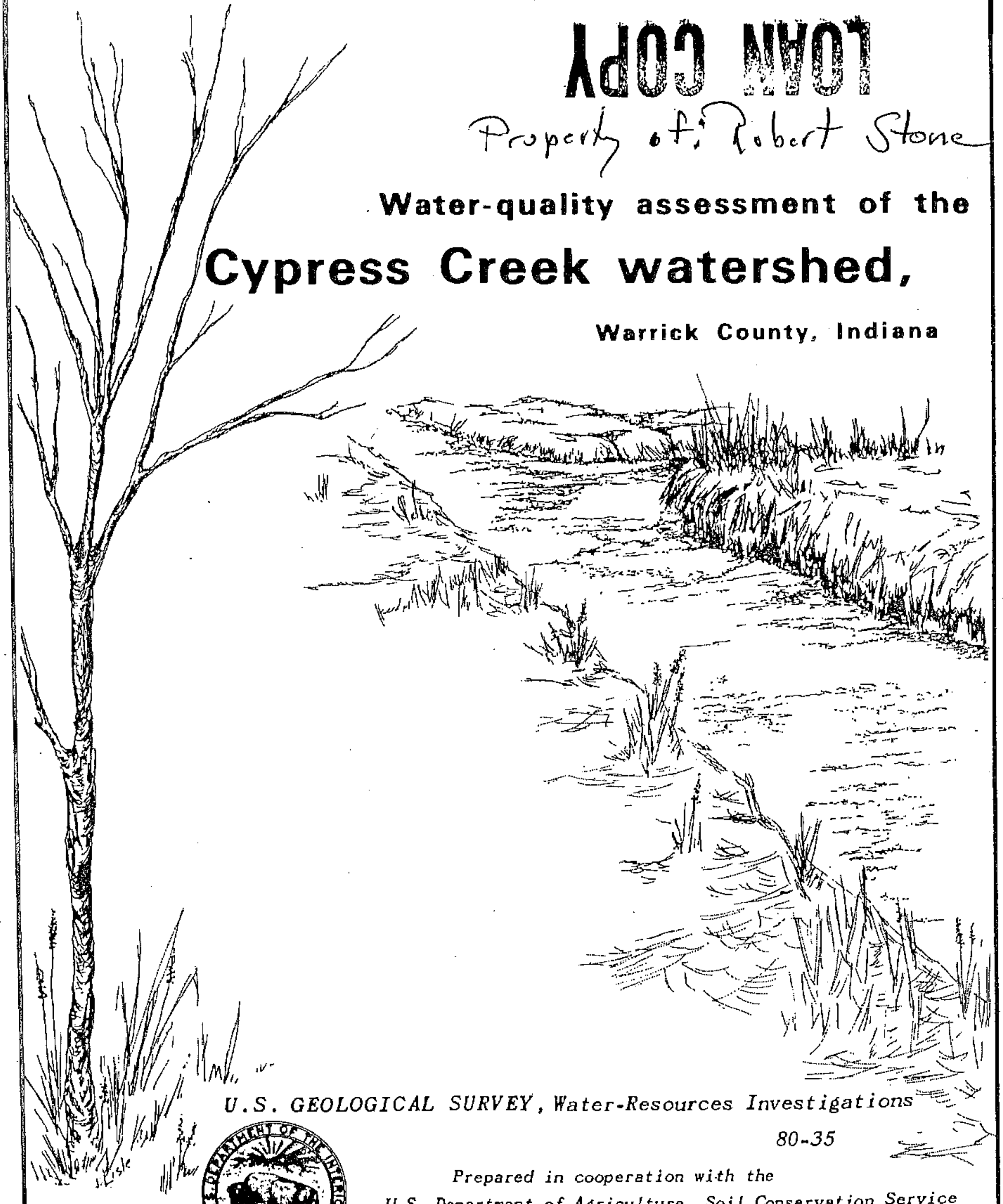
(4) Any determination made by the commissioner in accordance with Section 316 of the Clean Water Act concerning alternative thermal effluent limitations will be considered to be consistent with the policies enunciated in this section.

(Water Pollution Control Board; 327 IAC 2-1-2; filed Sep 24, 1987, 3:00 p.m.: 11 IR 579; filed Feb 1, 1990, 4:30 p.m.: 13 IR 1018; errata filed Jul 6, 1990, 5:00 p.m.: 13 IR 2003; filed Jan 14, 1997, 12:00 p.m.: 20 IR 1346)

Property of: Robert Stone

Water-quality assessment of the Cypress Creek watershed,

Warrick County, Indiana



U.S. GEOLOGICAL SURVEY, Water-Resources Investigations

80-35

Prepared in cooperation with the

U.S. Department of Agriculture, Soil Conservation Service

BIBLIOGRAPHIC DATA SHEET	1. Report No.	2.	3. Recipient's Accession No.

4. Title and Subtitle	5. Report Date
WATER-QUALITY ASSESSMENT OF THE CYPRESS CREEK WATERSHED, WARRICK COUNTY, INDIANA	May 1980
	6.
7. Author(s) Linda L. Bobo and Charles A. Peters	8. Performing Organization Rept. No. USGS/WRI 80-35
9. Performing Organization Name and Address U.S. Geological Survey, Water Resources Division 1819 N. Meridian Street Indianapolis, Indiana 46202	10. Project/Task/Work Unit No.
	11. Contract/Grant No.
12. Sponsoring Organization Name and Address U.S. Geological Survey, Water Resources Division 1819 N. Meridian Street Indianapolis, Indiana 46202	13. Type of Report & Period Covered Final. March to August 1979
	14.

15. Supplementary Notes Prepared in cooperation with the U.S. Department of Agriculture, Soil Conservation Service

Past and present surface coal mining is the factor having the greatest impact on water quality in the watershed. The general water type of Cypress Creek and most of its tributaries is calcium and magnesium sulfate. The water type at background site 21 on Summer Pecka ditch is calcium sulfate. Specific conductance ranged from 470 to 4,370 micromhos per centimeter at 25 degrees Celsius, and pH ranged from 1.2 to 8.8. Specific conductance, hardness, and concentrations of major ions and dissolved solids were highest in tributaries affected by mining. The pH was lowest in the same tributaries. Concentrations of iron, manganese, and sulfate in water samples and chlordane, DDT, and PCB's (polychlorinated biphenyls) in streambed samples exceeded water quality limits set by the U.S. Environmental Protection Agency. The Boonville sewage-treatment plant, immediately upstream from site 2 on Cypress Creek, is probably responsible for that site having the highest concentrations of nitrogen and phosphorus in water and streambed samples and the highest PCB concentration in streambed samples in the watershed.

17. Key Words and Document Analysis. 17a. Descriptors

Assessments, Bacteria, Biological communities, Chlorinated hydrocarbon pesticides, Discharge measurement, Erosion, Flooding, Indiana, Iron, Nutrients, Sediment load, Sewage, Strip mines, Surface waters, Water chemistry, and Water quality

17b. Identifiers/Open-Ended Terms

Acid mine drainage, Cypress Creek, Polychlorinated biphenyls, Reclaimed coal-mine land, Surface coal-mine land, Suspended sediment, and Unreclaimed surface coal-mine land

17c. COSATI Field/Group

18. Availability Statement	19. Security Class (This Report) UNCLASSIFIED	21. No. of Pages 76
No restriction on distribution	20. Security Class (This Page UNCLASSIFIED	22. Price

FORM NTIS-35 (REV. 10-73) ENDORSED BY ANSI AND UNESCO. THIS FORM MAY BE REPRODUCED USCOMM-DC 8265-P74

WATER-QUALITY ASSESSMENT OF THE CYPRESS CREEK WATERSHED, WARRICK COUNTY, INDIANA

By Linda L. Bobo and Charles A. Peters

U.S. GEOLOGICAL SURVEY

Water-Resources Investigations 80-35

Prepared in cooperation with the
U.S. Department of Agriculture,
Soil Conservation Service

May 1980

For sale by the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402

UNITED STATES DEPARTMENT OF THE INTERIOR

CECIL D. ANDRUS, Secretary

GEOLOGICAL SURVEY

H. William Menard, Director

For additional information write to:

U.S. Geological Survey
1819 N. Meridian Street
Indianapolis, Indiana 46202

CONTENTS

ILLUSTRATIONS

ILLUSTRATIONS--Continued

TABLES

METRIC CONVERSION FACTORS

The inch-pound units used in this report can be converted to the metric system of units as follows:

Multiply inch-pound-system unit	By	To obtain metric unit
inch (in)	25.40	millimeter (mm)
foot (ft)	0.3048	meter (m)
mile (mi)	1.609	kilometer (km)
square foot (ft^2)	0.0929	square meter (m^2)
square mile (mi^2)	2.590	square kilometer (km^2)
cubic foot per second (ft^3/s)	0.0283	cubic meter per second (m^3/s)
acre	0.4047	hectare (ha)
acre-foot	1,233	cubic meter (m^3)

WATER-QUALITY ASSESSMENT OF THE CYPRESS CREEK WATERSHED, WARRICK COUNTY, INDIANA

By Linda L. Bobo and Charles A. Peters

ABSTRACT

The U.S. Soil Conservation Service needs chemical, biological, microbiological, and hydrological data to prepare an environmental evaluation of the water quality in the Cypress Creek watershed before alternatives can be devised to (1) improve surface-water quality, (2) minimize flooding, (3) reduce sedimentation, and (4) provide adequate outlets for drainage in the watershed. The U.S. Geological Survey obtained these data for the Soil Conservation Service in a water-quality survey of the watershed from March to August 1979. Alternatives to the Watershed Protection and Flood Prevention Act (Public Law 566, 83d Congress) may also be devised to improve water-quality conditions.

Past and present surface coal mining is the factor having the greatest impact on water quality in the watershed. The upper reaches of Cypress Creek receive acid-mine drainage from a coal-mine waste slurry during periods of intense rainfall. All the remaining tributaries, except Summer Pecka ditch, drain mined or reclaimed lands.

The general water type of Cypress Creek and most of its tributaries is calcium and magnesium sulfate. In contrast, the water type at background site 21 on Summer Pecka ditch is calcium sulfate.

Specific conductance ranged from 470 to 4,370 micromhos per centimeter at 25 degrees Celsius, and pH ranged from 1.2 to 8.8. Specific conductance, hardness, and concentrations of major ions and dissolved solids were highest in tributaries affected by mining. The pH was lowest in the same tributaries.

Concentrations of iron, manganese, and sulfate in water samples and chlordane, DDT, and PCB's (polychlorinated biphenyls) in streambed samples exceeded water-quality limits set by the U.S. Environmental Protection Agency.

The Boonville sewage-treatment plant, immediately upstream from site 2 on Cypress Creek, is probably responsible for that site having the highest concentrations of nitrogen and phosphorus in water and streambed samples and the highest PCB concentration in streambed samples in the watershed.

Suspended-sediment concentration in Cypress Creek ranged from 91 to 776 micrograms per kilogram and increased with streamflow, which ranged from 4.26 to 2,300 cubic feet per second. A sieve analysis indicated that the particles being transported downstream in Cypress Creek during low flow on August 14, 1979, were 96 percent silt-and-clay size and 4 percent sand size.

INTRODUCTION

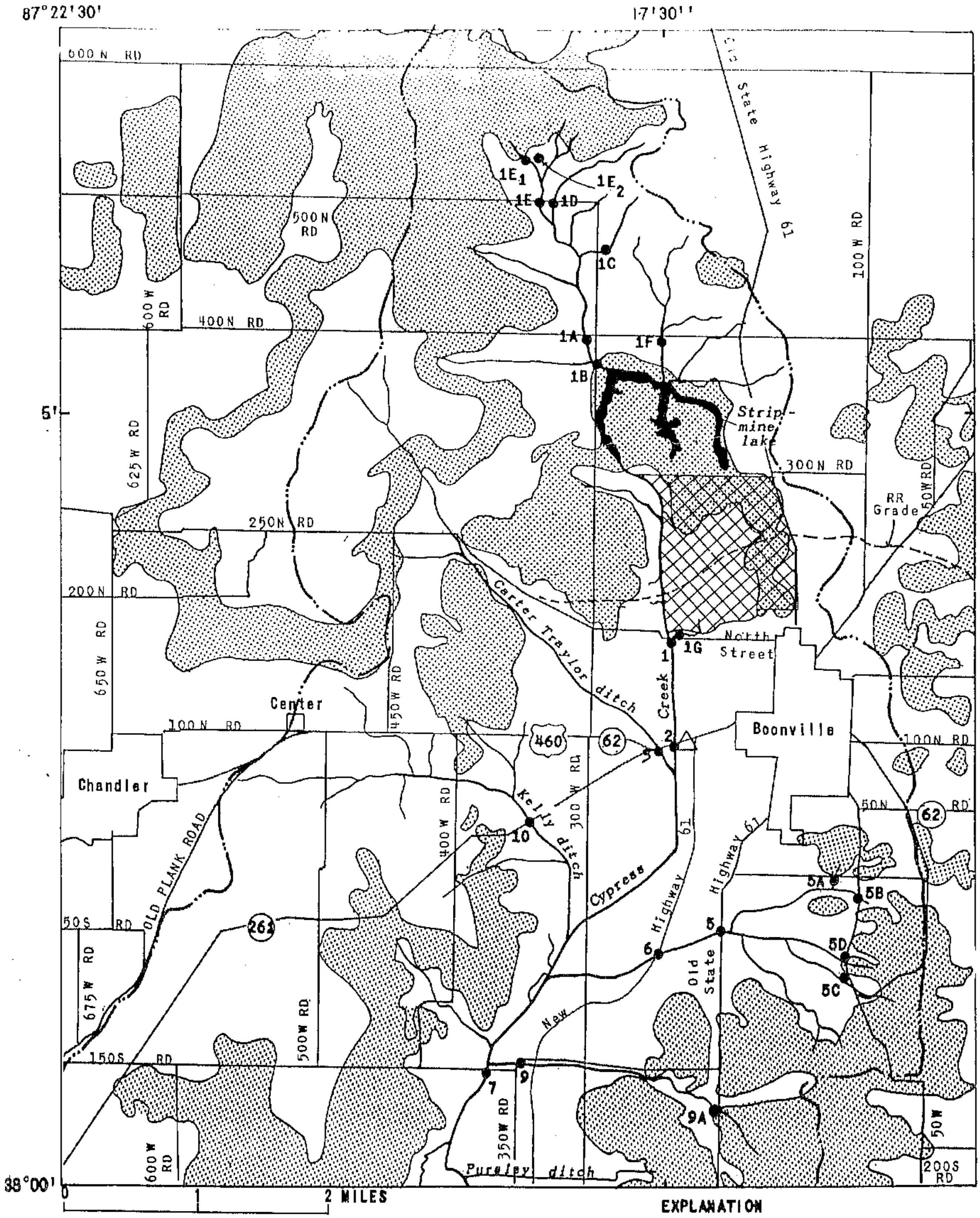
The main stem of Cypress Creek begins north of Boonville, Ind., and flows approximately 10 mi south into the Ohio River. The creek drains approximately 90 mi^2 (square miles) of nearly flat farmland and reclaimed strip-mine land in Warrick County in southwestern Indiana. Drainage areas (DA) for selected sites in the watershed are listed in the table that follows:

Cypress Creek		Tributaries of Cypress Creek	
Site	DA (mi^2)	Site	DA (mi^2)
1	8.8	5	2.1
2	9.7	9	.7
11	32.4	12	1.3
19	44.0	21	1.4

The far northern segment of Cypress Creek (north of Boonville) drains through old reclaimed surface coal-mine lands into a large surface coal-mine lake and then flows from the lake through reclaimed and unreclaimed surface coal-mine lands (fig. 1). The unreclaimed land contains a coal-mine waste slurry. The slurry area, northeast of site 1 (Cypress Creek), contains several low-pH tributaries (fig. 1) that drain into Cypress Creek during intense rainfall. However, during low flow, sediment dams restrict flow from these tributaries into Cypress Creek. Also, these tributaries have a significantly lower pH during low flow. Further downstream, the Boonville sewage-treatment plant is located north of sampling site 2 near State Highway 62 (fig. 1). The remaining downstream sites on Cypress Creek drain through primarily agricultural areas.

Most Cypress Creek tributaries drain active, reclaimed, and unreclaimed surface coal-mine lands (figs. 1 and 2). Summer Peoka ditch is the only tributary not flowing through surface coal-mine lands. However, Amax coal-mining operations are almost adjacent to the tributary several miles northwest of site 21.

Even though land use along Cypress Creek is approximately 65 percent cropland, 10 percent pasture, 10 percent woodland, and 15 percent surface coal-mine land, the creek will most likely be affected by surface coal mining because of its tributary drainage (fig. 1). Local crops consist mostly of corn, soybeans, and wheat. The area contains only a small amount of wood growth along the channel and little good timberland. Trees and grass are now stabilized in various parts of surface coal-mine land. In the future, coal may be mined in both new areas and in previously mined areas.



Base from U.S. Geological Survey Boonville 1:24,000, 1961 Revised from 1:80,000 aerial photographs taken May 9, 1977, EROS Data Center, Sioux Falls, S. Dak.

EXPLANATION

Mined areas

Coal-mine waste slurry

Sampling site and designation

Boonville sewage-treatment plant

Watershed boundary

Figure 1.-- Locations of sampling sites in the Cypress Creek watershed, Boonville area.

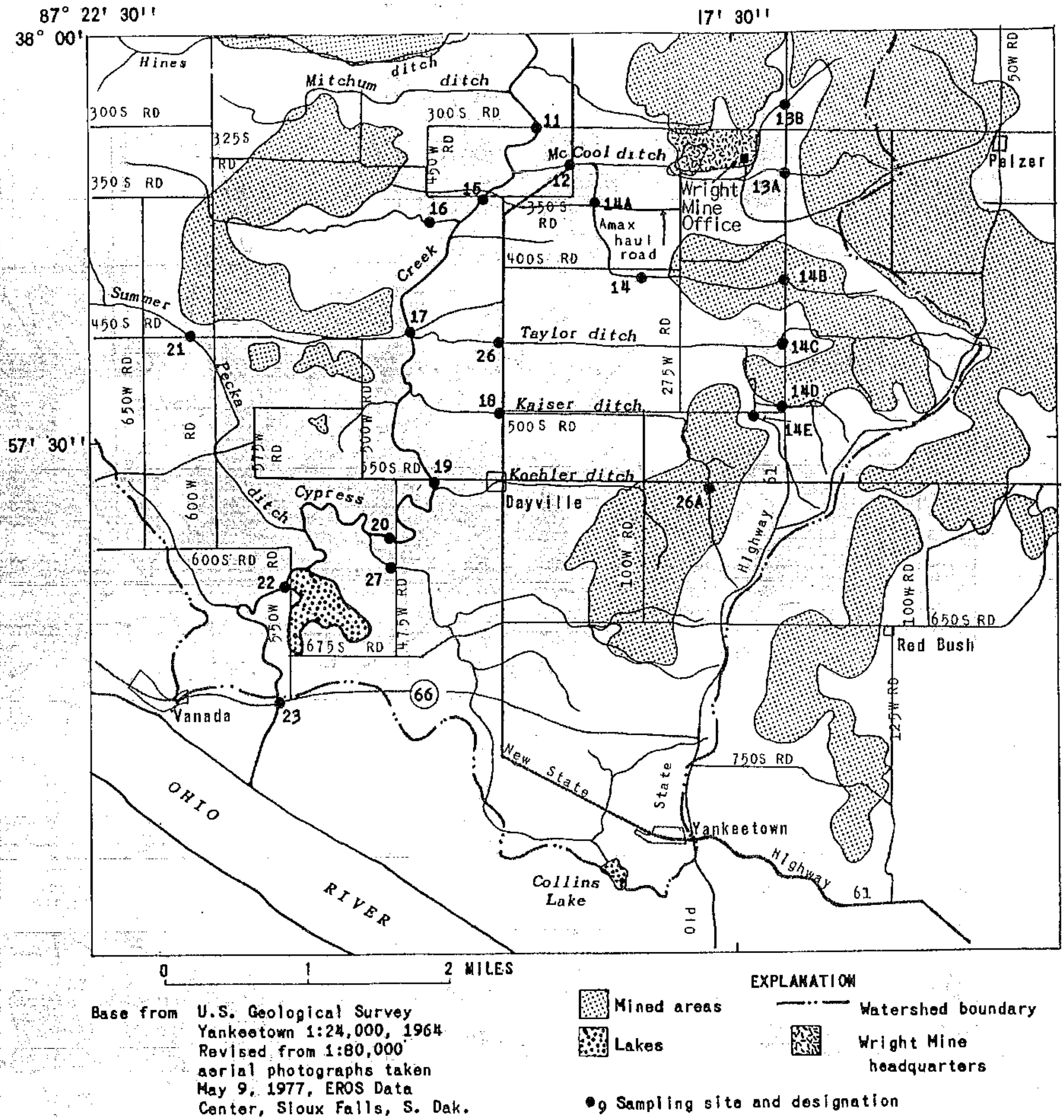


Figure 2.-- Locations of sampling sites in the Cypress Creek watershed, Yankeetown area.

Of the 4,000 inhabitants in the 42,280-acre watershed in Warrick County, 300 are farmers and 2,600 are residents of the town of Boonville. The size of about half the farms is 80 acres or less, and residents of Boonville are heavily employed by the mines (primarily by Peabody and Amax) and by the Alcoa plant.

Soils are mostly on or in formations of siltstone, shale or sandstone that have a silty loess cap (Shively, 1979, p. 1). Loess thickness ranges from 2.5 ft in the north part of the watershed to 20 ft in the south part. The main source of loess is the lowlands along the Wabash and Ohio Rivers to the west and south (Shively, 1979, p. 1). Soils in the north range from well to poorly drained and have slow percolation rates; soils in the south are generally poorly drained. Generally, bottom lands are flooded, terraces are wet, and uplands are eroding.

The watershed is in an unglaciated area in the Pleistocene Atherton Formation underlain by Pennsylvanian bedrock of the Dugger and Petersburg Formations of the Carbondale Group, which consists of shale, sandstone, limestone, clay, and the Danville coal member of the Dugger and Springfield coal member of the Petersburg (Gray, Wayne, and Wier, 1970).

The broad, nearly flat tract of the watershed is in the Wabash Lowland physiographic unit (Schneider, 1966, p. 48), whose average elevation is 500 ft above National Vertical Geodetic Datum (NGVD) of 1929 (formerly called "mean sea level"). The shallow channel of Cypress Creek cuts into lacustrine deposits. Unreclaimed land consists of coarse shale, sandstone, limestone, and clay, whereas reclaimed land consists of fine particles of the same materials.

During the study, mean monthly temperature ranged from 19°F (January 1979) to 76°F (July 1979) at the Spurgeon weather station (National Oceanic and Atmospheric Administration, 1979). Mean annual rainfall is 45 in. (inches), and parts of the watershed are flooded two to three times a year by intense rains. Rainfall is usually heaviest in April and lightest in October and November. Mean annual runoff is 12 in. (Hoggatt, 1962, p. 9). Maximum and minimum air temperatures and precipitation at the Spurgeon weather station from January 1979 through August 1979 are presented in figure 3.

Problems

Intense rains cause flooding on an average of two to three times a year to cropland, roads, and bridges. During flooding, backwaters of the Ohio River reach as far north as site 19 on Cypress Creek. High suspended-sediment loads, moderate and severe sheet erosion from adjacent lands, and general lack of aquatic life are additional problems.

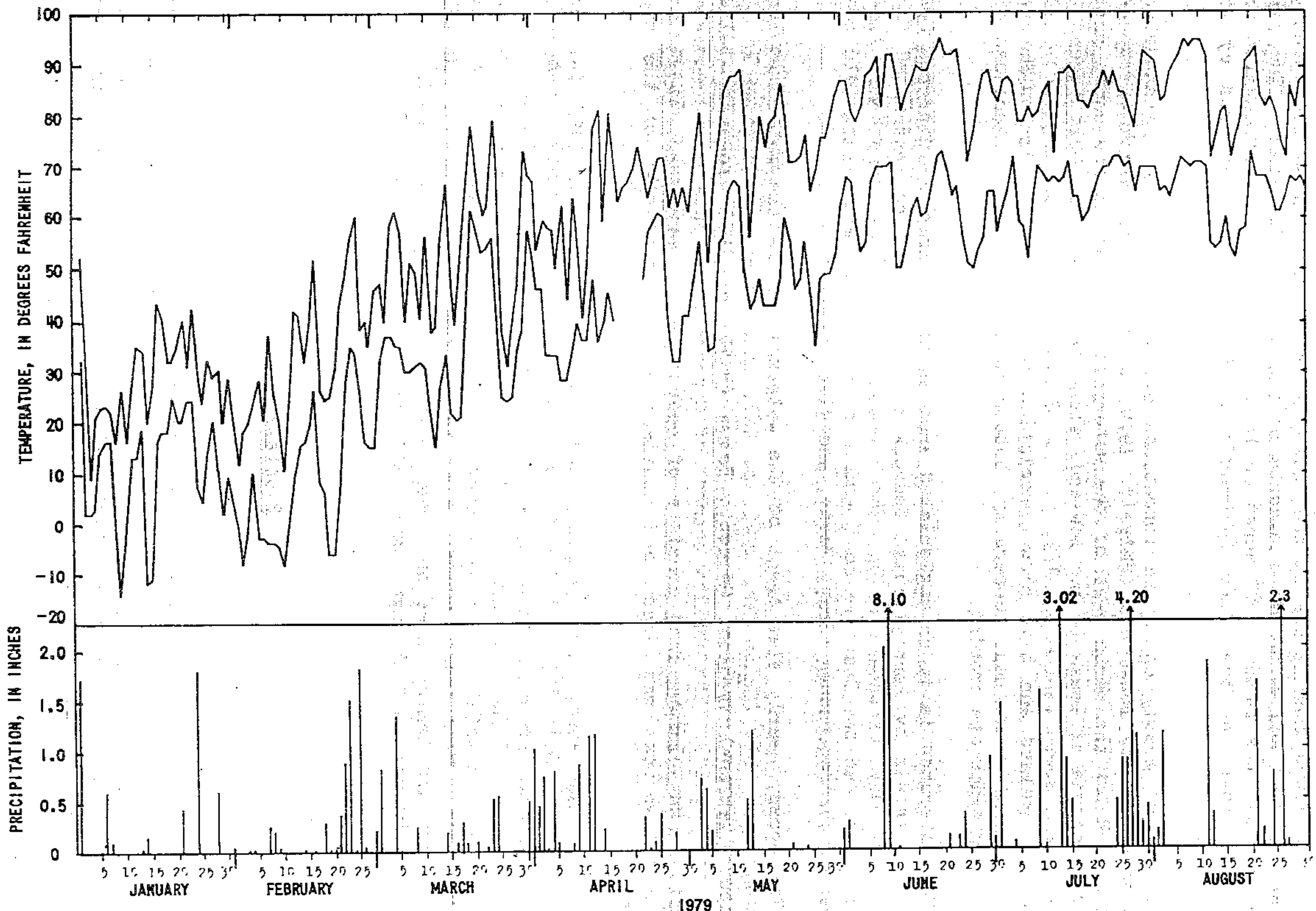


Figure 3.-- Precipitation and maximum and minimum air temperatures at the Spurgeon, Ind., weather station (data from National Oceanic and Atmospheric Administration, 1979).

The County Drainage Board cleared Cypress Creek channels of trees and woody growth and now clear new growth annually.(Robert Rasely, Soil Conservation Service, written commun., March 1979). In the March 1979 reconnaissance, no growth of any kind was observed along the channels of the creek, but high suspended-sediment loads and severe erosion of streambanks and adjacent fields were observed in Cypress Creek during intense rains at this time. General lack of fishlife was also noted in the August 1979 sampling after several severe rainstorms and floods. In contrast, several carp and other aquatic animals were noted at sites 11 and 19 in the June 1979 sampling.

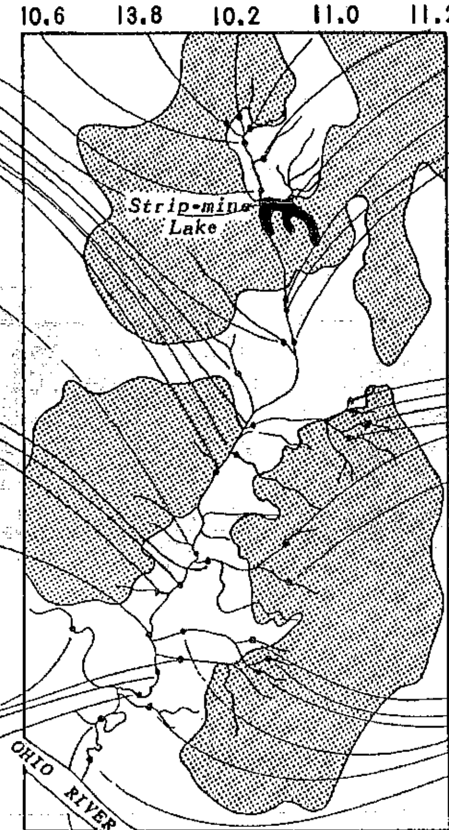
Purpose and Scope

This study is one in a series of surface-water-quality assessments of watersheds by the U.S. Geological Survey in cooperation with the Soil Conservation Service (SCS). Data collected by the Geological Survey for the Cypress Creek watershed will be used by the SCS to prepare an environmental evaluation of the water quality before SCS devises alternatives to (1) improve surface-water quality, (2) minimize flooding, (3) reduce sedimentation, and (4) provide adequate outlets for drainage. Alternatives to the Watershed Protection and Flood Prevention Act (Public Law 566, 83d Congress) may also be devised to improve water-quality conditions (Robert Rasely, Soil Conservation Service, oral commun., May 1, 1980).

Data were collected by the Geological Survey in March, April, June, July, and August 1979 to (1) define variations in concentrations of selected heavy metals, major ions, chlorinated hydrocarbons, nutrients (compounds of nitrogen and phosphorus), suspended sediment, organic carbon, and fecal coliform and fecal streptococcal bacteria, as well as variations in counts and identification of periphyton communities, and (2) identify possible sources of water-quality problems.

Eh, pH, specific conductance, dissolved-oxygen concentration, and water temperature were measured in a basinwide reconnaissance (table 1 and fig. 4) on March 19-21, 1979. These data (fig. 4) provided information for selecting sites for further study to assess the general water quality. Followup water-quality surveys were done at sites 1, 2, 11, and 19 (Cypress Creek) on April 10-12, June 11-13, July 25-26, August 13-14, 1979, and at sites 5, 9, 12, and 21 (tributaries) on June 11-13, 1979, to obtain data for different seasons and streamflow conditions.

Subsequent field trips involved field measurements of Eh, pH, specific conductance, and instantaneous and estimated stream discharge; collection of water samples for laboratory determination of concentrations of selected heavy metals, nutrients (nitrogen and phosphorus compounds), major ions, organic carbon (dissolved, suspended, and total), bacteria (fecal coliform and fecal streptococcus), and suspended sediments; and collection of streambed samples for the determination of concentrations of chlorinated hydrocarbons, nitrogen, phosphorus, aluminum, iron, manganese, and total organic and inorganic carbon.



10	3	1B	1A	1E	1E$_1$	1E$_2$	1D	1C	1F	1G	1	2
3/20/79	3/20/79	3/19/79	3/19/79	3/19/79	3/19/79	3/19/79	3/19/79	3/19/79	3/19/79	3/19/79	3/19/79	3/20/79
1120	1045	1555	1420	1455	1500	1505	1445	1435	1600	1600	1640	1055
12.5	12.5	13.5	13.5	13.5	13.5	12.5	13.0	12.5	13.6	—	11.5	11.6
7.4	7.2	8.0	8.2	8.1	8.2	7.6	7.8	7.5	7.2	1.7	5.1	6.4
1300	1100	2000	2000	3000	3050	1800	1200	190	315	—	1300	1200
+210	+310	+380	+350	+370	+410	+340	+390	+380	+270	—	+430	+290
10.6	10.8	10.8	10.1	10.6	13.8	10.2	11.0	11.2	9.6	—	10.6	10.5

6	9	7	11
3/20/79	3/20/79	3/20/79	3/20/79
1540	1230	1210	1550
14.5	13.5	12.5	13.0
8.2	7.7	7.0	7.1
1900	2200	1300	1400
+360	+210	+210	+200
10.6	10.8	8.9	9.2

5A	5B	5D	5C
3/21/79	3/21/79	3/21/79	3/21/79
1315	1300	1235	1220
16.5	14.9	15.3	13.5
6.5	7.9	7.0	7.4
2100	1600	1350	1200
+270	+245	+345	+330
9.6	10.4	9.1	10.2

12	15	16	17
3/20/79	3/20/79	3/20/79	3/21/79
1245	1315	1345	1500
14.0	12.5	14.0	7.2
8.1	7.3	7.8	15.3
2550	1500	860	1200
+308	+190	+310	+310
12.6	9.2	11.4	9.5

13B	13A	14C	14D
3/21/79	3/20/79	3/21/79	3/21/79
1330	1600	1410	1425
17.6	18.5	18.0	20.0
8.0	7.9	8.2	8.1
3500	2135	1450	1400
+285	+345	+370	+360
14.8	13.6	12.6	12.6

21	18	19	20
3/20/79	3/20/79	3/20/79	3/20/79
1440	1540	1500	1640
13.0	14.5	13.3	13.5
7.8	8.2	7.3	7.4
400	1900	1500	1500
+330	+360	+250	+365
10.8	15.0	9.2	9.3

22
3/20/79
1655
13.2
7.3
1500
+400
8.6

23	27	26	14E
3/20/79	3/20/79	3/20/79	3/21/79
1710	1605	1520	1430
10.5	13.5	14.0	22.0
7.2	7.9	8.3	7.9
1100	710	1860	1600
+380	+370	+300	+390
9.1	11.4	12.8	12.7

EXPLANATION

1D	Sampling site designation
3/19/79	Date (month/day/year)
1445	Military time of day, or 2:45 p.m.
13.0	Water temperature, in degrees Celsius
7.8	pH
1200	Specific conductance, in microhmos per centimeter at 25° Celsius
+390	Eh, in millivolts
11.0	Dissolved oxygen, in milligrams per liter
	Mined areas: active, reclaimed and unreclaimed

Figure 4.--Locations of sites and data collected in reconnaissance in the Cypress Creek watershed, March 19-21, 1979.

On July 25, 1979, a core sample was taken at a depth of 2 ft into the streambed at site 11. In addition, streambed surface samples were collected at sites 1, 2, 11, and 19. Chlorinated hydrocarbon concentrations of the core and the streambed surface samples were determined by the Geological Survey laboratory. Also, on July 25, 1979, field measurements were made at all sites (tables 2 and 3).

During an 8-week period in the summer, jumbo multiplate samplers were placed at selected sites in the stream for colonizing benthic invertebrates communities. At the same time, mylar strips were placed at selected sites in the stream for colonizing periphyton. The samplers and strips were placed at sites 1, 2, 11, and 19 (Cypress Creek) on June 13, 1979, and were collected on August 14, 1979. In addition, an Eckman[1] grab was used in attempting to collect samples of resident benthic invertebrate communities from the stream bottom at sites 1 and 19 on July 25 and August 14, 1979.

METHODOLOGY

Methods used in collecting data were those approved by the Geological Survey, through various technical memorandums and training manuals.

In the reconnaissance (fig. 4) and in subsequent field trips, pH, specific conductance, Eh (redox potential), air and water temperatures, and dissolved-oxygen concentrations were measured in the stream with a Hydrolab (multiparameter instrument). A platinum electrode and a reference electrode attached to the Hydrolab were used to measure Eh. Average values based on measurements in depth- and width-integrated cross sections are reported in figure 4 and tables 2 and 3. Low flow in June and August 1979 was measured with a pygmy meter attached to a wading rod, and high flow in April 1979 was measured with an AA flowmeter suspended from a bridge rig. Streamflow was estimated on July 25 and 26, 1979.

In low-flow conditions, the authors waded into the streams and collected samples; in high-flow conditions, they used the bridge rig and accessories to collect all stream samples from the bridge. Methods for bridge-rig sampling and stream-gaging techniques are outlined by Carter and Davidian (1968, p. 6-7) and Brown and others, (1970, p. 9-12).

[1]The use of brand names is for identification only and does not imply endorsement by the U.S. Geological Survey.

Raw water samples were taken in depth- and width-integrated cross sections of the stream with a D.H.-48 sampler containing a 0.2-in. nozzle. A churn sample splitter was used for maximum cross-section mixing of the water sample (Ralph Pickering, written commun., December 13, 1976). Samples were filtered with the Sartorius stainless steel tank and filter system equipped with a 0.45-mm nitrocellulose filter (Ralph Pickering, written commun., April 5, 1978). The water used in all filtering processes was taken from the churn sample splitter. Water samples collected for dissolved, suspended, and total organic carbon were filtered by a Millipore silver filter organic-carbon kit (Ralph Pickering, written commun., December 28, 1976, and Goerlitz and Brown, 1972, p. 4-6). All these water samples were chilled for shipment to the Geological Survey laboratory for determination of selected inorganic and organic constituents.

The D.H.-48 suspended-sediment sampler was used for collection of width- and depth-integrated suspended sediment samples (Ralph J. Pickering, written commun., January 17, 1977; Guy and Norman, 1970; and Guy, 1970). Streambed samples for determining concentrations of chlorinated hydrocarbons, selected organic-carbon constituents, nutrients, aluminum, iron, and manganese were collected by methods suggested by Ralph J. Pickering (written commun., June 19, 1975). Samples for chlorinated hydrocarbon determination were placed in sterilized glass jars, and the remaining samples were placed in nontransparent plastic containers. A core sample 2.0 ft into the streambed was taken at site 11 by a piston-type, bed-material hand sampler (US BMH-53 corer) to determine chlorinated hydrocarbon concentrations. All these samples were chilled for shipment to the laboratory. Methods used for determination of fluvial sediments and inorganic substances in water were those outlined by Skougstad and others (1979).

Water samples for determination of fecal streptococci and fecal coliform were collected in sterilized glass bottles, were chilled immediately, and were plated within 3 hours after collection. Bacterial colonies were then counted by the Geological Survey after full incubation (24 hours at 44°C for fecal coliform and 48 hours at 35°C for fecal streptococci). Methods of collection and analysis of bacterial samples that were used are outlined by Greeson and others (1977, p. 53 and 59).

Mylar strips and jumbo multiplates were placed in the stream for the colonization and determination of periphyton populations and benthic invertebrates, respectively (Greeson and others, 1977, p. 127 and 159). Additionally, dredging of the streambed for collection of samples of resident benthic invertebrate communities was attempted with an Eckman grab as outlined in Greeson and others (1977, p. 148).

RESULTS

Field Measurements

Water temperatures generally paralleled concurrent air temperatures and seasonal variations and ranged from 10.5° to 29.2°C. The lowest temperature was at site 10 on April 10, 1979, and the highest was at sites 3 and 12 on June 12, 1979.

Specific conductance ranged from 470 to 4,370 µmho/cm (micromhos per centimeter) at 25°C. The highest value was measured at site 13A on June 12, 1979. Generally, tributaries affected by past or present surface coal-mining operations had higher specific conductance values than Cypress Creek. The lowest specific conductance was measured at site 19 on Cypress Creek on July 26, 1979, probably owing to dilution after the intense rain on the evening of July 25, 1979 (figs. 5 and 6). However, the increase in specific conductance at sites 1 and 2 during high flow in July 1979 (fig. 6) was probably due to the flushout of tributaries and overland flow draining the coal-mine waste slurry just north of site 1 (fig. 1). Tributaries that drain the slurry flow into Cypress Creek only during or immediately after intense rainfall.

The pH ranged from 1.2 to 8.8. However, all but three values are within the range from 6.5 to 8.5, typical for natural streams (Hem, 1970, p. 93). The lowest pH was measured at site 1-G, on a tributary draining the coal-mine waste slurry. The highest pH was measured in June 1979 at site 15. Values of pH were lower in tributaries affected by past or present surface coal-mining operations than in Cypress Creek and were higher in August 1979 than in April 1979 at most sites. Values of pH in Cypress Creek were generally lower during periods of high flow when the creek receives drainage from low-pH tributaries, such as the one at site 1-G. The pH at sites on the tributaries did not correlate with streamflow.

Dissolved-oxygen concentration, generally near theoretical saturation at most sites, ranged from 45 (site 1, June 12, 1979) to 212 (site 18, June 13, 1979) percent of saturation (tables 2 and 3). The concentration was less than saturation at most sites in July 1979. The concentrations at sites 5 and 21 were consistently less than saturation. Flow at site 5 is from an area of reclaimed surface coal mines. Site 21 is near a pig feedlot that may contribute some organic loading. There was no correlation between dissolved-oxygen concentration and the ratio, FC/FS (fecal coliform/fecal streptococcus). Also, dissolved-oxygen concentrations were not significantly higher for high flow than for low flow.

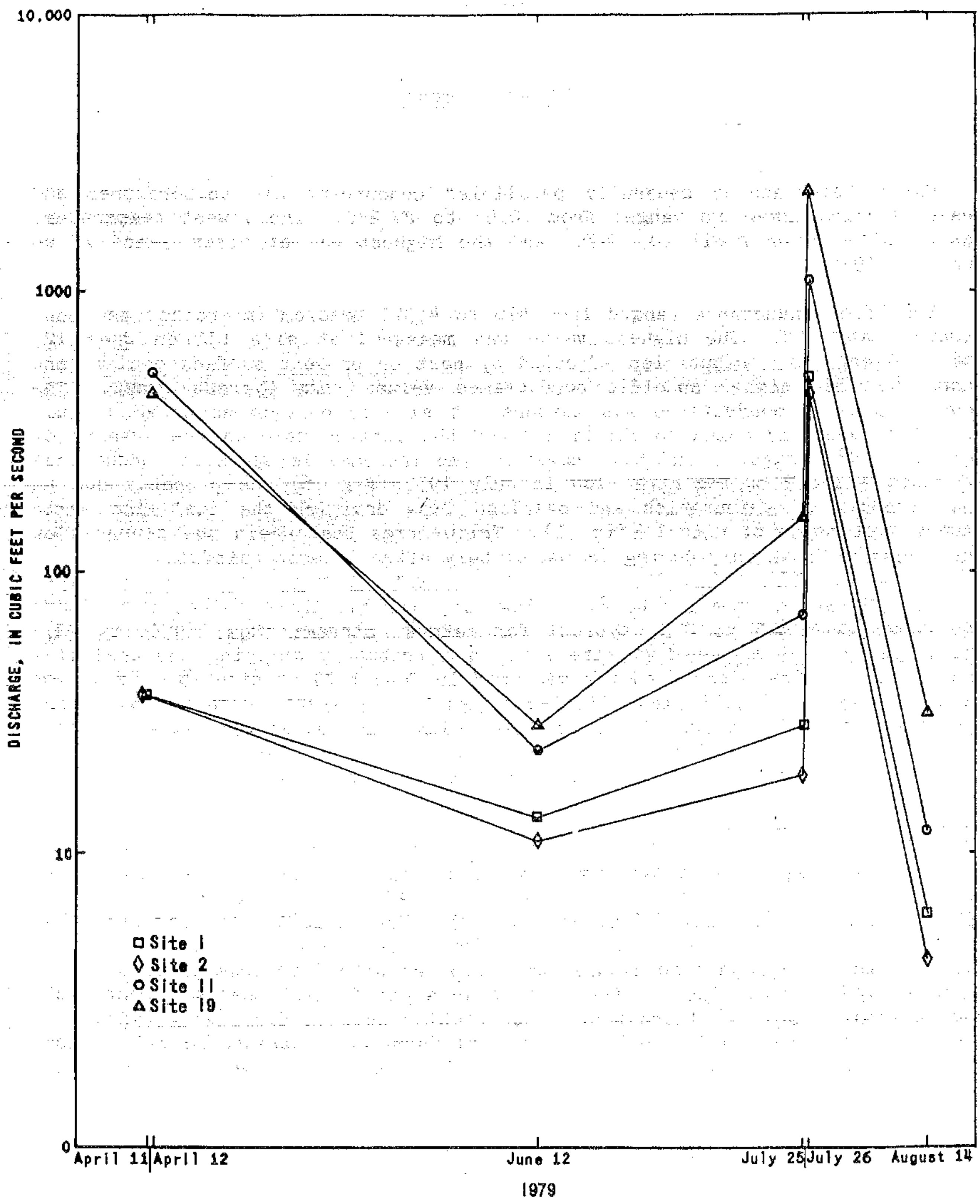


Figure 5.-- Fluctuations of stream discharge at selected sampling sites in the Cypress Creek watershed.

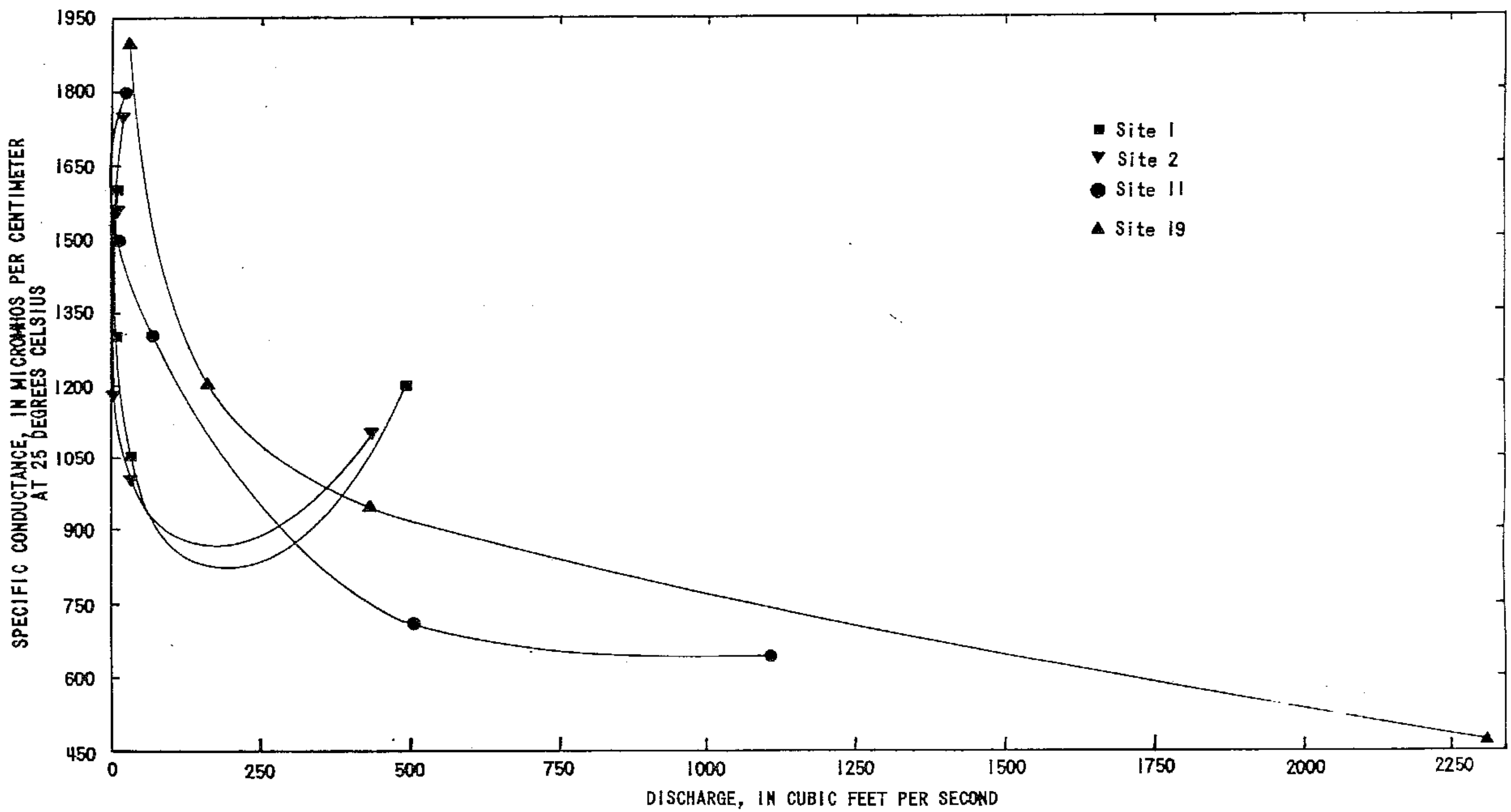


Figure 6.-- Relation of specific conductance to stream discharge in the Cypress Creek watershed.

Oxidation-reduction potential (Eh) measures the relative intensity of oxidation or reduction in solutions. Oxidizing systems are assigned positive potentials, and reducing systems are assigned negative potentials (Hem, 1970, p. 229). The Eh values in the watershed ranged from +120 to +790 millivolts. Approximately 90 percent of the values are between +200 and +400 millivolts. The lowest Eh value was measured at site 14 during low flow on August 13, 1979, a site just downstream from the Amax haul road (fig. 2).

Discharge (instantaneous measurements and estimated values), during the study varied by season and drainage area and ranged from 4.26 to 2,300 ft^3/s. The flood on Cypress Creek on July 26, 1979, is documented in table 2 and figure 5. High flow was apparent in April and July 1979 and low flow in June and August 1979 (fig. 5).

Chemical Data

Inorganic Constituents in Water and Streambed Samples

Major ions and related constituents.--The water type of Cypress Creek, calcium and magnesium sulfate, is illustrated by Stiff patterns (Stiff, 1951) in figure 7. Although dilution of all ionic concentrations in Cypress Creek was observed during the high flow of the April 1979 sampling, the ionic balance was not significantly affected. This dilution is normal when discharge increases rapidly during periods of intense rainfall, as was noted at sites 1, 2, 11, and 19 on Cypress Creek on July 26, 1979 (fig. 5 and table 4). Specific conductance, dissolved-solids concentration, and hardness also showed effects of dilution during periods of high flow (fig. 6 and table 4). The effects of dilution on these properties relates to the dilution of the cation and anion concentrations because specific conductance, dissolved-solids concentration, and hardness are an indication of the amounts of dissolved ions in water.

Calcium and magnesium sulfate water type is also characteristic of streams flowing through areas of reclaimed surface coal mines in the Busseron Creek watershed (Eikenberry, 1978, p. 11). Although Cypress Creek flows through primarily agricultural lands, its upper reaches flow through an area that includes a reclaimed surface coal mine and a coal-mine waste slurry. Cypress Creek is also affected by the influx of its tributaries, most of which flow through reclaimed and active surface coal-mine areas. These areas could be additional contributors of magnesium, calcium, and sulfate ions into the stream.

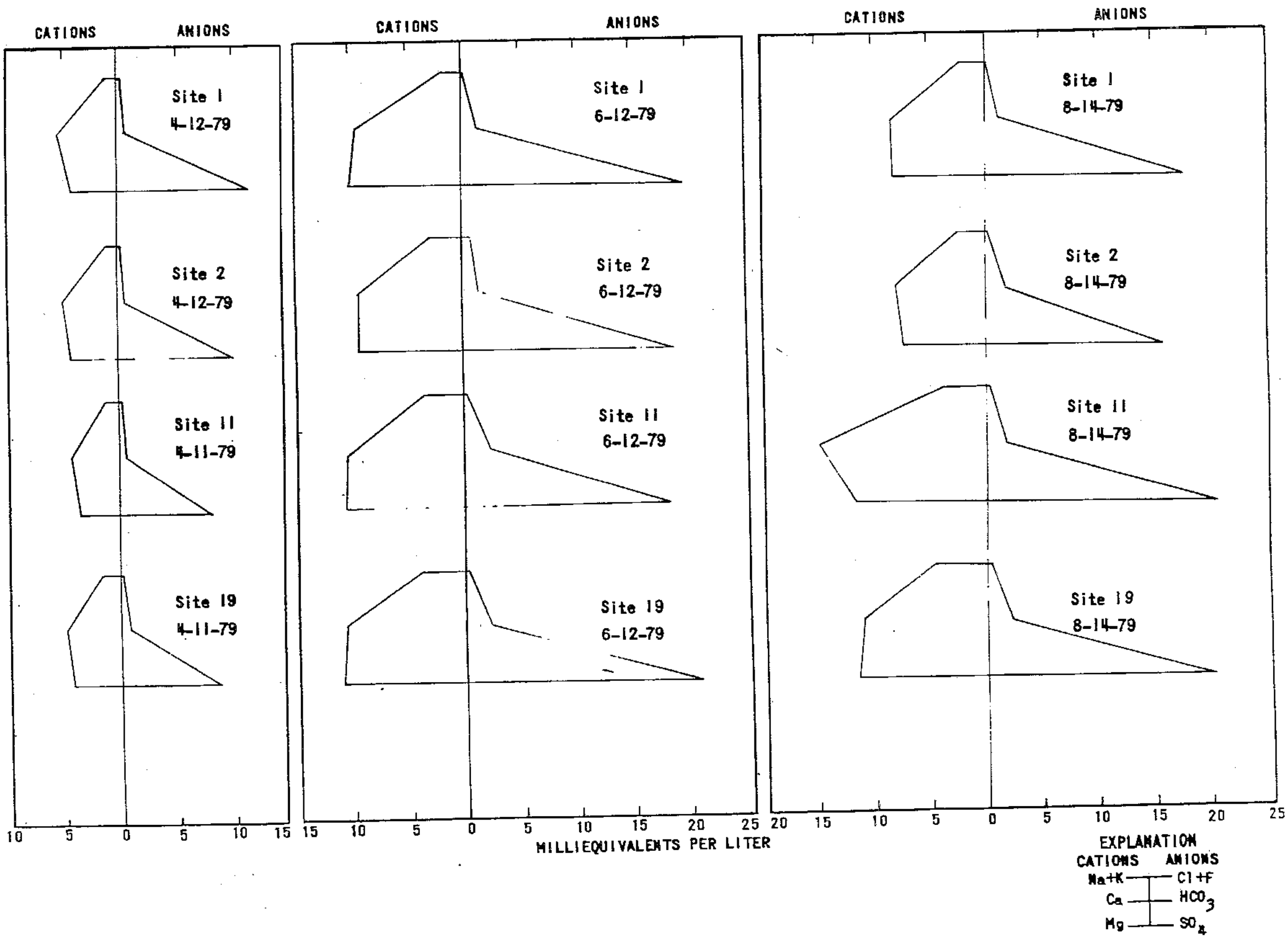


Figure 7.-- Stiff patterns representing analyses of water samples from Cypress Creek.

Water type at tributary sites 9 and 12 was magnesium sulfate. These sites, downstream from active and reclaimed surface coal-mine areas, had the highest concentrations of calcium, magnesium, and sulfate ions in the watershed (table 4).

Water type at tributary site 5 was the same as that of Cypress Creek, calcium and magnesium sulfate, but ionic concentrations were greater at site 5 for the June 1979 sampling period (figs. 7 and 8) than in Cypress Creek. Site 5 is on a tributary to Cypress Creek, just below the influx of three other tributaries that flow through reclaimed surface coal-mine lands; however, site 5 is on agricultural land (fig. 1).

Site 21, on Summer Pecka ditch, was chosen as the background site because the ditch flows through primarily agricultural land unaffected by past or present surface coal-mining operations. The water type at site 21 was calcium sulfate, and the concentrations of ions were low in comparison with those of Cypress Creek and its tributaries that flow from areas of reclaimed and active surface coal mines.

Sulfate concentrations exceeded the 250-mg/L limit for domestic water supplies (U.S. Environmental Protection Agency, 1976, p. 394) at all sites during all sampling runs except for background site 21. These high sulfate concentrations are probably due to influences of past and present surface coal mining.

Concentrations of chloride throughout the study were less than the limits set for domestic water supply (U.S. Environmental Protection Agency, 1976, p. 394) for all sites during all sampling periods.

Sodium concentrations increased downstream from site 1 to site 19 in Cypress Creek in all three sampling periods (fig. 7 and table 4) and were higher at tributary sites 9 and 12 in June 1979 than at any other sites and at any other sampling times (figs. 7 and 8).

Use of water for irrigation is dependent on the ratios of various cations in the water and the osmotic effects of dissolved solids (U.S. Environmental Protection Agency, 1976, p. 399). The SAR (sodium-adsorption ratio) can be used to predict the degree to which irrigation water tends to enter into cation-exchange reactions in soil (Hem, 1970, p. 228).

An SAR was calculated by the Geological Survey laboratory as follows:

$$SAR = \frac{(Na^{+})}{\sqrt{\dfrac{(Ca^{+2}) + (Mg^{+2})}{2}}}$$

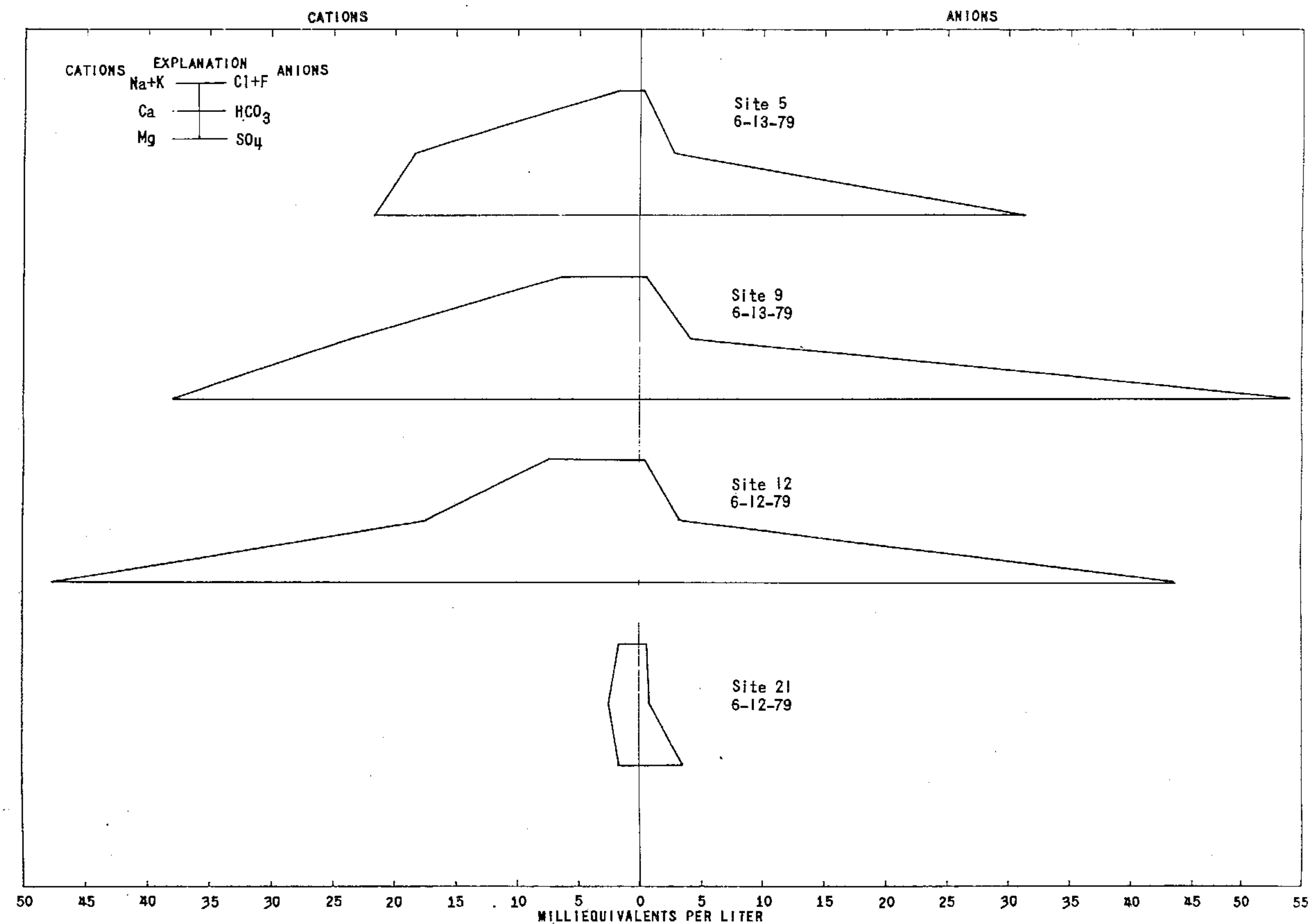


Figure 8.-- Stiff patterns representing analyses of water samples from tributaries of Cypress Creek.

High SAR values imply replacement of adsorbed calcium and magnesium in the soil by sodium and damage to the soil system (Hem, 1970, p. 228). For general crops and forages, the tolerance for sodium in irrigation water is within an SAR range from 8 to 18 (U.S. Environmental Protection Agency, 1976, p. 400). All SAR values were less than the values in this range. Sites 9, 11, 12, 19, and 21 had the highest SAR values in June 1979 (table 4). SAR values were lowest in April 1979 during high flow. SAR values ranged from 0.4 to 1.4, and percent sodium ranged from 4 to 28 during the study period. Site 21 had the highest percent sodium, 28 in June 1978 (table 4).

Even though sodium concentrations were highest in tributaries flowing through reclaimed and active surface coal-mine areas, sources of sodium are still probably deposited within the soil because site 21, the background site, unaffected by surface coal-mining, had a high SAR and the highest percent sodium. Because divalent cations are usually preferentially held in exchange positions on clay minerals, the displacement of calcium and magnesium by sodium is unlikely unless the percent sodium exceeds 50 (Hem, 1970, p. 229). All percent sodium values were less than 50. However, present surface coal-mining operations probably affect the sodium concentration to a degree because tributary sites 9 and 12 had the highest sodium concentrations and the lowest percent-sodium values (table 4).

Sodium can be retained by adsorption on mineral surfaces such as clay particles, which have high cation-exchange capacities (Hem, 1970, p. 145). A sieve analysis of suspended sediment samples collected on August 14, 1979, indicated that 96 percent of the particles being transported downstream in Cypress Creek was silt and clay size and 4 percent was sand size.

Tributary drainage from active and past surface coal-mining operations directly affect the water quality of Cypress Creek. Environmental changes such as an uplift of land surface during surface-mining operations impose a freshwater leaching regime where soluble salts readily go into solution and are usually quickly removed from coarse grain sediments (Hem, 1970, p. 146). Some of these sediments may contain readily soluble sodium salts. Suspended and settleable solids and dissolved constituents can be transported from these tributaries into Cypress Creek.

Dissolved-solids concentrations ranged from 626 to 1,790 mg/L at Cypress Creek sites 1, 2, 11 and 19. Concentrations were highest during low flow in June 1979 and were lowest during high flow in April 1979. Dissolved-solids concentrations at the tributary sites ranged from 316 mg/L (at background site 21) to 4,040 mg/L (table 4). Concentrations of dissolved solids at tributary sites 5, 9, and 12 were within the 2,000- to 5,000-mg/L range for water that can be used with careful management practices for tolerant plants on permeable soils. At background site 21, the concentration was less than the 500-mg/L limit for water from which no detrimental effects will usually be noticed. The concentrations at Cypress Creek sites 1, 2, 11, and 19, during low flow in June and August 1979, were within the 1,000- to 2,000-mg/L range for water that may have adverse effects on many crops and that requires careful management practices (U.S. Environmental Protection Agency, 1976, p. 399).

Total hardness ranged from 390 to 1,100 mg/L at Cypress Creek sites 1, 2, 11, and 19 and from 180 to 3,300 mg/L at tributary sites 5, 9, 12, and 21. Dilution effects on hardness, specific conductance, and dissolved-solids concentration were apparent during high flow in April 1979 (table 4 and fig. 9). All hardness values were greater than 300 mg/L, an indication of very hard water according to the classification set by the U.S. Environmental Protection Agency (1976, p. 147), except for the background site 21 (180 mg/L).

Hardness of water is predominantly attributable to the presence of calcium and magnesium ions, although other metals, such as iron and manganese, also cause hardness (U.S. Environmental Protection Agency, 1976, p. 147). Concentrations of all these metals, as well as hardness of water, are high at all sites, except at background site 21. The high values of hardness and major ions at tributary sites 5, 9, and 12 can probably be attributed to discharges from operating surface coal mines, abandoned surface coal mines, or streams flowing through reclaimed surface coal-mine land.

Dilution of specific conductance corresponded to dilutions of hardness and concentrations of major ions and dissolved solids during periods of high flow (tables 2 and 4 and fig. 9). Because of this relationship of specific conductance to these constituents, concentrations of major ions, dissolved solids, and hardness will also likely decrease at the tributary sites during periods of intense rainfall and high streamflow, when specific conductance decreases (table 3). The tributary sites were sampled only in June 1979, a period of low flow, but field measurements were made at the sites for each sampling period. Specific conductance values seem to decrease during periods of intense rainfall and increased streamflow throughout the watershed.

Alkalinity is the sum of components in water that tend to elevate the pH of water above a value of about 4.5 and is a measure of water-buffering capacity. Constituents that increase alkalinity include carbonates, bicarbonates, phosphates, and hydroxides (U.S. Environmental Protection Agency, 1976, p. 11). Alkalinity concentrations ranged from 39 to 340 mg/L. The lowest alkalinity concentration was at site 1 on April 11, 1979, and may have been due to the inflow of low-pH tributaries from the coal-mine waste slurry (as at site 1G that are upstream from site 1). Alkalinity concentration generally increases in downstream order at sites 2, 11, and 19 (table 4), which indicates that the creek is buffering out the effects of drainage received from low-pH tributaries.

<u>Nitrogen and Phosphorus Compounds</u>.--Major nutrients in water and soils include nitrogen and phosphorus compounds. Nitrogen compounds can enter water through (1) municipal and industrial wastewaters, (2) septic tanks, (3) feedlot discharges, (4) farm-site fertilizer and animal wastes, (5) lawn fertilizer, (6) atmospheric fallout, and (7) losses from natural sources such as mineralization of soil organic matter (U.S. Environmental Protection Agency, 1976, p. 201-202). Crop, forest, idle, and urban lands can contribute phosphorus compounds in runoff of rainfall or return flow from irrigation (U.S. Environmental Protection Agency, 1976, p. 353).

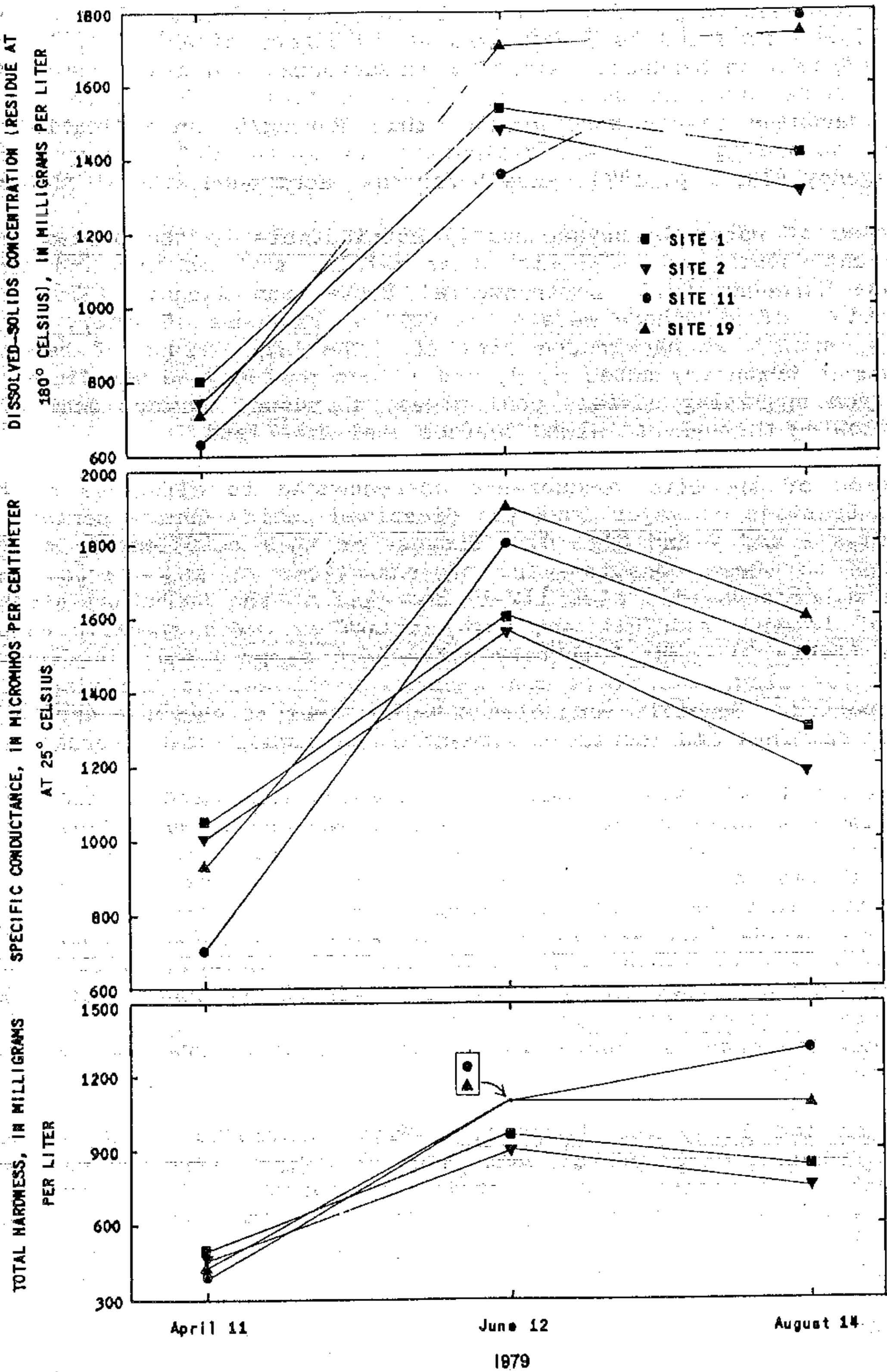


Figure 9.-- Distribution of dissolved-solids concentrations, specific conductance, and hardness at selected sites in Cypress Creek watershed.

Concentrations of nitrogen compounds dissolved in streams ranged (1) from 0.08 to 1.2 mg/L for nitrogen ammonia, dissolved as NH_4; (2) from 0.14 to 0.77 mg/L for nitrogen, dissolved organic as N; (3) from 0.93 to 3.6 mg/L for nitrogen, dissolved as N; and (4) from 0.13 to 1.8 mg/L for nitrite plus nitrate, dissolved as N (table 5). Concentrations of the nitrogen compounds (reported as nitrogen) varied seasonally (fig. 10). Generally, high concentrations were detected in June 1979 and low concentrations in April and August 1979.

The concentration limit of nitrate in domestic water supplies is 10 mg/L as nitrogen (US. Environmental Protection Agency, 1976, p. 203). Nitrate concentrations at all sampling sites were below this limit.

Ammonia concentrations greater than 0.10 mg/L (as nitrogen) in surface water often indicates sewage or industrial contamination (National Academy of Sciences and the National Academy of Engineering, 1972, p. 55). Ammonia concentrations greater than 0.10 mg/L (nitrogen, ammonia, dissolved as NH_4) were detected at all sites sampled, except for background site 21 on June 12, 1979, and site 1 on August 14, 1979 (table 5). These concentrations are probably high because of (1) past and present surface coal-mining operations and (2) the Boonville sewage-treatment plant upstream from site 2.

Concentrations of phosphorus ranged (1) from 0.00 to 0.20 mg/L for phosphorus (dissolved as phosphorus); (2) from 0.00 to 0.42 mg/L for phosphate, ortho, dissolved (PO_4) as phosphorus; and (3) from 0.00 to 0.14 mg/L for phosphorus, dissolved orthophosphate as phosphorus (table 5).

The elemental form of phosphorus is toxic and can bioaccumulate, whereas phosphate is a major nutrient required for plant nutrition and is essential to life (U.S. Environmental Protection Agency, 1976, p. 352). Concentrations of phosphorus or phosphate that exceed or equal 0.10 mg/L (as phosphorus) can cause plant nuisances in flowing water (U.S. Environmental Protection Agency, 1976, p. 356). In June 1979, water samples from sites 2 and 9 (table 5) had concentrations of phosphorus or phosphate that exceeded or equaled 0.10 mg/L (as phosphorus). Plant nuisances were observed at site 9 but not at site 2; however, site 2 may be affected by the Boonville sewage-treatment plant, which could be a contributing source of phosphorus.

Nitrogen and phosphorus in streambed material have a variety of sources. Runoff from fields where nitrogen and phosphorus-based fertilizers have been used is among the largest contributors, estimated to be 24 lb/acre/yr (pounds per acre per year), as nitrogen in surface water (Feth, 1966, p. 41). Accumulations of refractory remains of algae in bottoms of rivers and lakes should tend to build up reservoirs of organic nitrogen and phosphorus (McCarty and others, 1968, p. 135). Crop residues and animal wastes also contribute nitrogen and phosphorus, as do sewage-treatment plants (Brady, 1974, p. 424).

Concentration of nitrogen in streambed samples ranged from 4,600 mg/kg to 23,000 mg/kg as nitrogen (table 5). The high and low concentrations were detected on August 14, 1979, at sites 1 and 19, respectively.

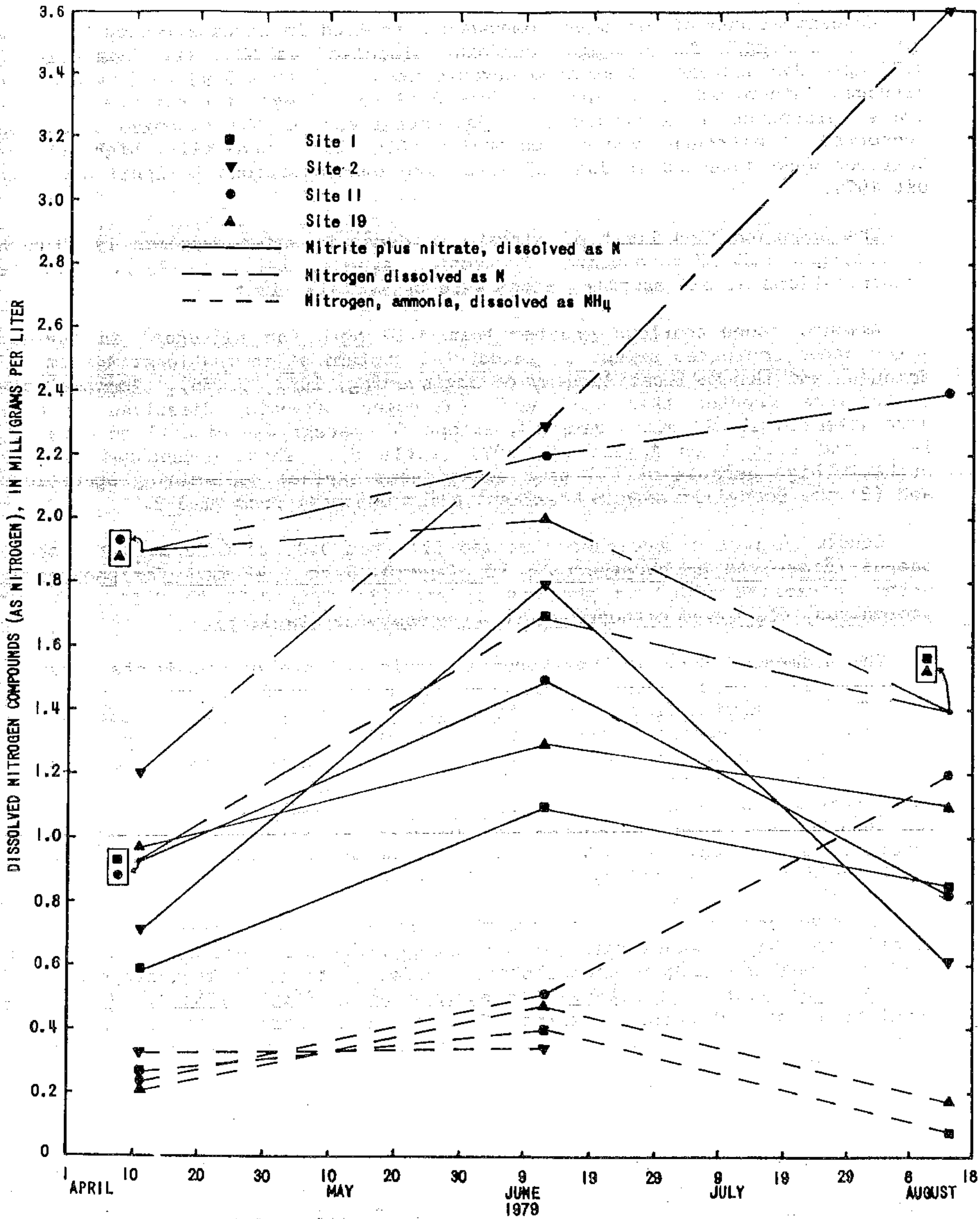


Figure 10.-- Seasonal distribution of concentrations of dissolved nitrogen compounds (reported as nitrogen) at selected sites in the Cypress Creek watershed.

Concentrations of phosphorus in streambed samples ranged from 0 mg/kg to 1,900 mg/kg as phosphorus. Phosphorus was not detected in streambed samples collected in April 1979 at sites 1, 2, and 19. The highest concentration was detected at site 2 on June 12, 1979. The low concentrations of phosphorus in April 1979 may have been due to (1) dilution during high flow at this time or (2) no fertilizing of fields by April 1979. The highest concentrations of phosphorus were detected in June 1979, possibly owing to low flow and fertilization of crops.

Phosphorus concentration of streambed samples was highest at site 2 in both June and August 1979, possibly owing to effects from the Boonville sewage-treatment plant upstream from the site. Phosphorus concentration at site 1 was the lowest of all samplings.

The amounts of phosphorus in soils largely determine the concentrations in local surface water, unless local pollution from animal or human sources is a factor (Thomas, 1970, p. 16). Nitrogen and phosphorus concentrations of both water and streambed samples were highest at site 2, which was occasionally affected by sewage.

The tributaries had much lower nitrogen and phosphorus concentrations and lower flow and less runoff from adjacent fields than Cypress Creek. At all sites, nitrogen concentrations of streambed samples were much higher than phosphorus concentrations.

Aluminum.--Common sources of aluminum in water are minerals, clays, and mine drainage (Hem, 1970, p. 109, 113). Because the aluminum is so abundant in the earth's outer crust, most natural waters have ample opportunity to dissolve it; however, the complexity of aluminum chemistry probably accounts for low aluminum concentrations in near neutral pH water (Hem, 1970, p. 109). The pH at the sampling sites ranged from 6.4 to 7.4, and most aluminum concentrations were in the suspended rather than dissolved phase (table 4).

Concentrations of total aluminum ranged from 0.12 to 0.85 mg/L in Cypress Creek and from 0.15 to 2.0 mg/L in the tributaries (table 4). Highest total aluminum concentrations were detected at tributary site 9 on June 12, 1979, and at Cypress Creek site 1 on June 12 and August 14, 1979 (table 4). Both sites are directly affected by either present or past surface coal-mining operations.

Concentrations of aluminum in streambed samples ranged from 3,600 to 11,000 μg/kg in Cypress Creek and from 4,600 to 11,000 μg/kg in the tributaries (table 6). Highest aluminum concentrations in streambed samples were at tributary site 5 on June 13, 1979, and Cypress Creek site 11 on April 12, 1979, and August 14, 1979 (table 6).

Iron.--Iron is generally present as ferrous ion in the dissolved phase and as ferric ion in the suspended phase. Concentrations of suspended iron were greater than dissolved iron at all sites (fig. 11 and table 4), which is normal in surface water where pH ranges from 6.4 to 7.4 and Eh exceeds 0.20 volt (Hem, 1970, p. 120).

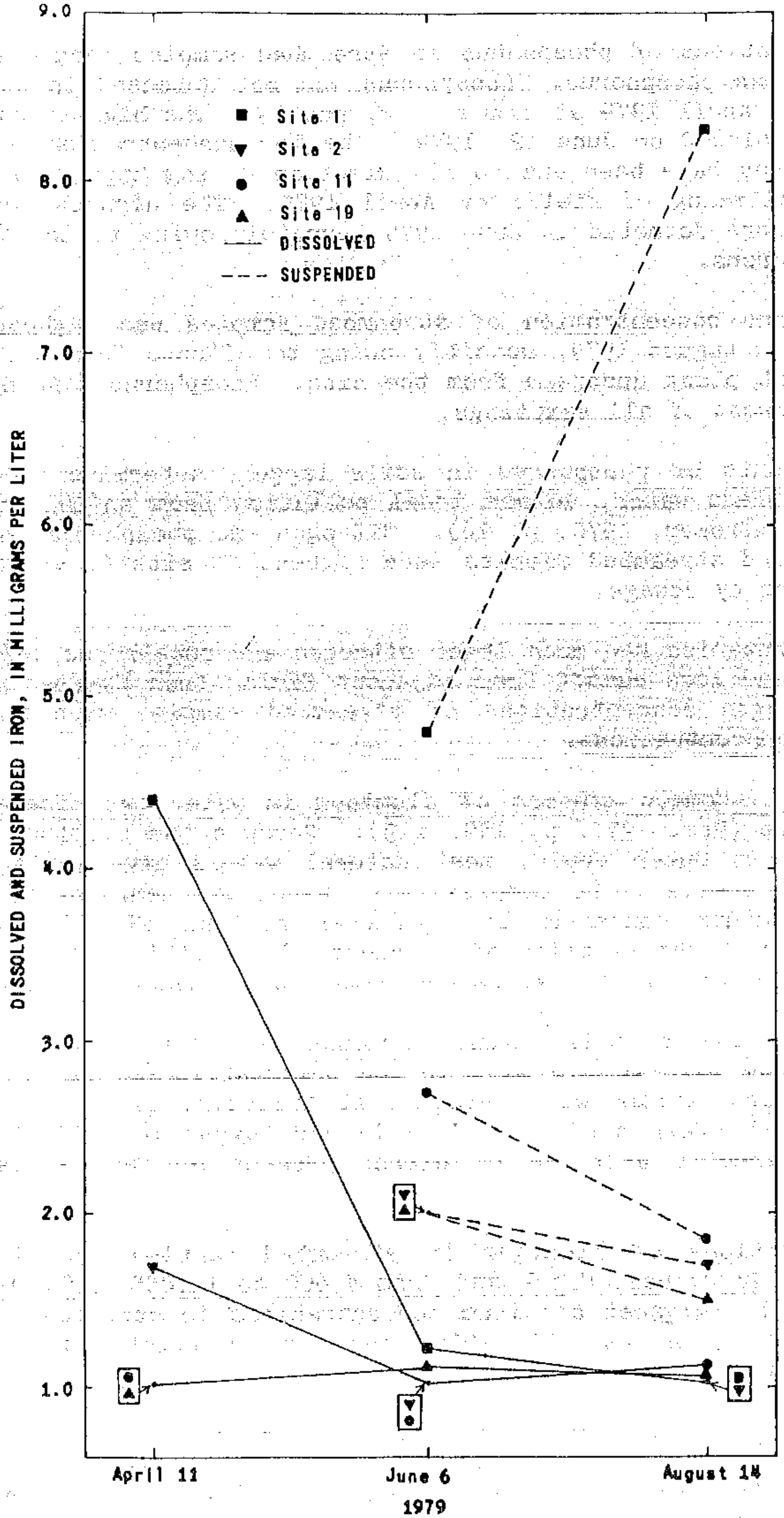


Figure 11.--Trends of dissolved- and suspended-iron concentrations at selected sites in the Cypress Creek watershed.

Dissolved iron concentrations at sites 1 and 2 on April 11, 1979, and total iron concentrations at all sites exceeded the 0.3 mg/L limit set by the U.S. Environmental Protection Agency (1976, p. 152) for domestic water supply. Dissolved iron at site 1 on April 11 and total iron at sites 1, 11, 19, 9, and 21 in June 1979 and at site 1 on August 14, 1979, exceeded the 1.0-mg/L limit set by the U.S. Environmental Protection Agency (1976, p. 152) for fresh-water aquatic life.

Sources of iron in the watershed are probably the soil and past and present surface coal-mining operations. Drainage from the coal-mine waste slurry upstream from site 1 and low-pH tributaries, such as at site 1-G (pH, 1.2), probably contribute additional quantities of iron into Cypress Creek. For low-pH conditions such as these, iron is mostly in the dissolved phase. In the presence of dissolved oxygen, dissolved iron is precipitated as a yellow or red hydroxide or oxide (U.S. Environmental Protection Agency, 1976, p. 153). Red deposits were observed on the surface of the streambed upstream from site 1 and at site 1 near the edge of water from which the low-pH tributary (at site 1G) occasionally drains into Cypress Creek and at tributary sites 5 and 5 A-D. The pH was near neutral at all these sites (tables 2 and 3). When iron flock is suspended in water, as during high streamflow with corresponding increased sediment loads and stream discharge, the flock can be detrimental to fish and other aquatic life (U.S. Environmental Protection Agency, 1976, p. 153).

Iron in soil is a vital micronutrient and an essential trace element required by both plants and animals (Brady, 1974, p. 22). Concentrations of iron in streambed samples ranged from 15,000 to 48,000 µg/kg (table 6 and fig. 12). Iron concentration in soil commonly ranges from 5,000 to 50,000 µg/kg, and the iron concentration of a representative surface soil is commonly 25,000 µg/kg (Brady, 1974, p. 23). Major natural sources of iron in soil are oxides, sulfides, and silicates of iron (Brady, 1974, p. 489).

Manganese.--Manganese and iron are closely related in chemical behavior (Hem, 1970, p. 130). Both are constituents of acid-mine drainage from coal mines. However, manganese persists in river water for greater distances downstream than iron. As an acid stream neutralizes, manganese takes longer to precipitate out of solution than iron (Hem, 1970, p. 130). Generally, manganese was present in greater concentrations in the dissolved rather than the suspended phase--the opposite that of iron. Distribution of dissolved- and suspended-iron and manganese concentrations in water are presented in figures 11 and 13, respectively.

Dissolved-manganese concentrations exceeded the 50-µg/L limit set by the U.S. Environmental Protection Agency (1976, p. 178) for domestic water supplies at all sites in the watershed except for background site 21 (table 4). Dissolved-, suspended-, and total- manganese concentrations ranged from 0.07 to 3.0 mg/L, from 0 to 1.1 mg/L, and from 0.13 to 4.1 mg/L, respectively.

Manganese concentration ranging from slightly less than 1 mg/L to a few milligrams per liter in irrigation water applied to soils having pH values lower than 6.0 may be toxic to plants; however, concentrations of manganese

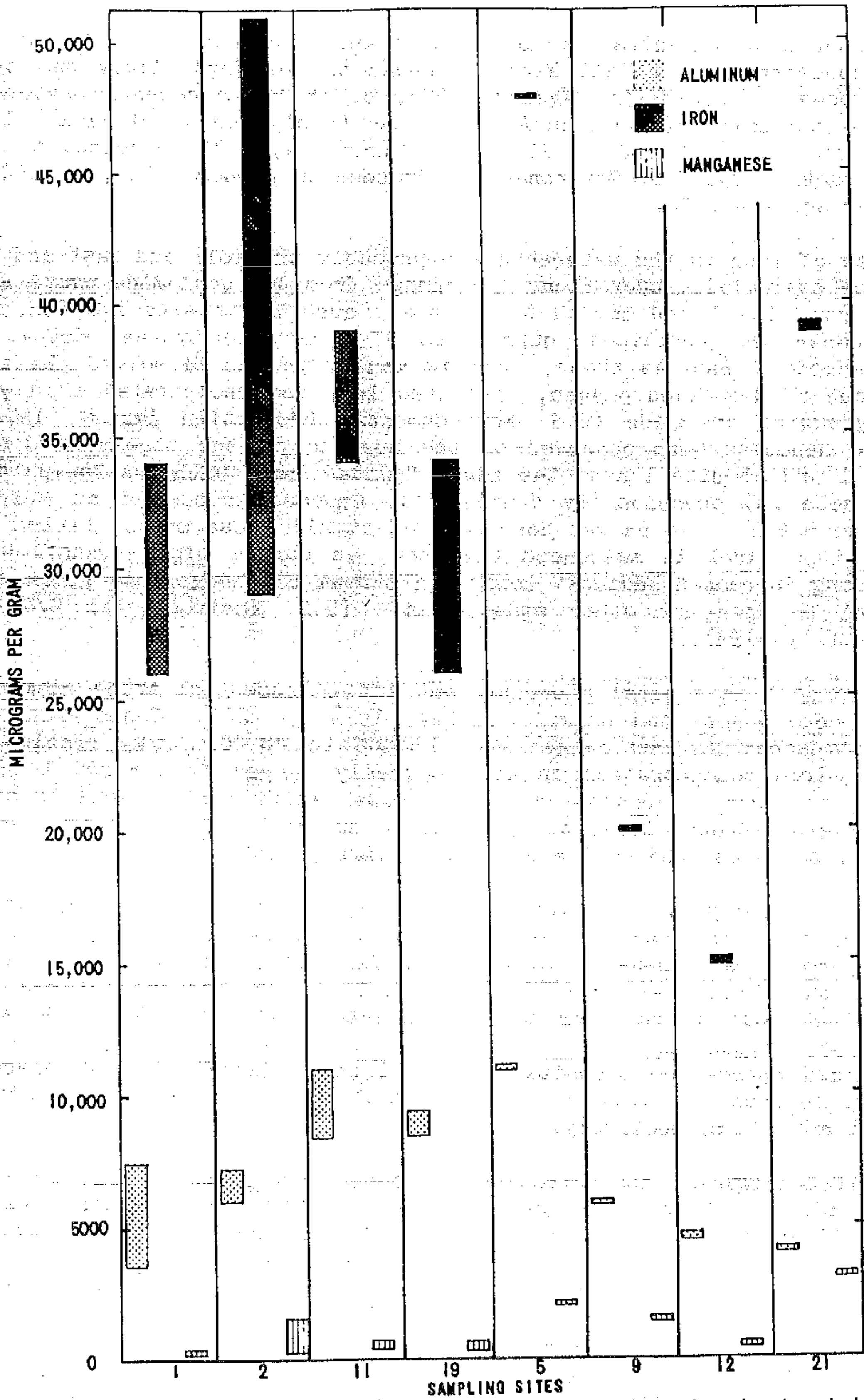


Figure 12.-- Ranges of aluminum, iron, and manganese concentrations in streambed samples at selected sites in the Cypress Creek watershed.

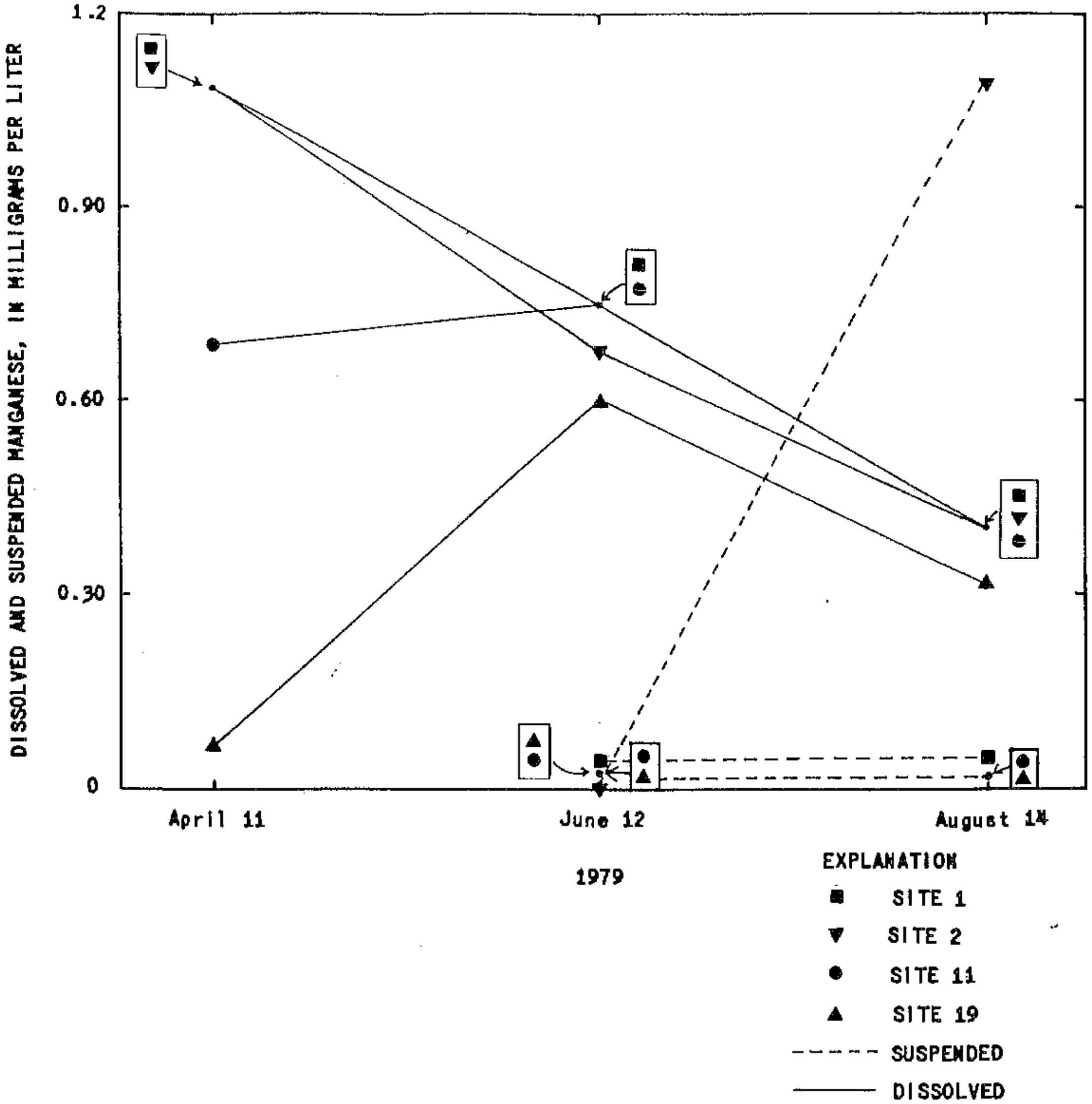


Figure 13.-- Trends of dissolved- and suspended-manganese concentrations at selected sites in the Cypress Creek watershed.

in surface water are rarely greater than 1 mg/L (U.S. Environmental Protection Agency, 1976, p. 180). Dissolved-manganese concentrations were greater than 1.0 mg/L at Cypress Creek sites 1 and 2 in April 1979 and at tributary sites 5 and 9 in June 1979 (table 4). These high concentrations may have been due to tributary drainage from the coal-mine waste slurry upstream from site 1 and drainage from active and past surface coal-mining operations affecting tributary sites 5 and 9.

Seasonal distributions of dissolved-organic carbon and dissolved-manganese concentrations are plotted in figures 13 and 14, respectively, for Cypress Creek sites 1, 2, 11, and 19. Generally, manganese concentrations were highest in April 1979 during high flow and lowest in August 1979 during low flow. Concentrations of dissolved manganese (fig. 13) and total suspended sediment (fig. 15) followed the same trends at sites 1 and 2 with each successive sampling from April through August 1979, which suggests that sources of dissolved and suspended manganese are not only the soil but possibly suspended and settleable solids being transported downstream with or on suspended sediment.

Some major sources of manganese include freshly fallen leaves and other plants (Hem, 1964, p. B3). A high percentage of manganese can be leached from freshly fallen leaves (Oborn, 1964, p. C12) and naturally occurring organic substances, especially fulvic acid (Zajicek and Pojasek, 1976, p. 306), are a factor in the solubilization and transport of manganese in aquatic systems. Although the channels of Cypress Creek are cleared annually of growth, trees and crops grow on fields adjacent to the banks of the creek. Relationships between dissolved manganese and organic carbon would be apparent from early fall to early winter in streams unaffected by mining. Both concentrations decreased in the August 1979 sampling period, a period of low flow and a considerably lower suspended-sediment load.

Manganese is a vital micronutrient for both plants and animals and is used as a micronutrient fertilizer additive (U.S. Environmental Protection Agency, 1976, p. 178). Major natural sources of manganese in soil are oxides, silicates, and carbonates (Brady, 1974, p. 489).

The normal range of manganese concentration in soils is from 200 to 10,000 ug/g. A normal manganese concentration in a representative surface soil is 2,500 ug/kg (Brady, 1974, p. 23). Concentrations of manganese in streambed samples ranged from 260 to 3,100 ug/kg (fig. 12 and table 6). Manganese concentrations in streambed samples for the Cypress Creek sampling sites were highest in April 1979 during high flow; however, the highest manganese concentrations in streambed samples were at tributary sites 5, 9, and 21 in June 1979. Sources of manganese at sites 5 and 9 are probably past and present surface coal-mining operations, farming operations, and soil. Sources of manganese for background site 21 are probably farming operations and soil.

Ranges of concentrations of aluminum, iron, and manganese in streambed materials for all sites sampled are plotted in figure 12.

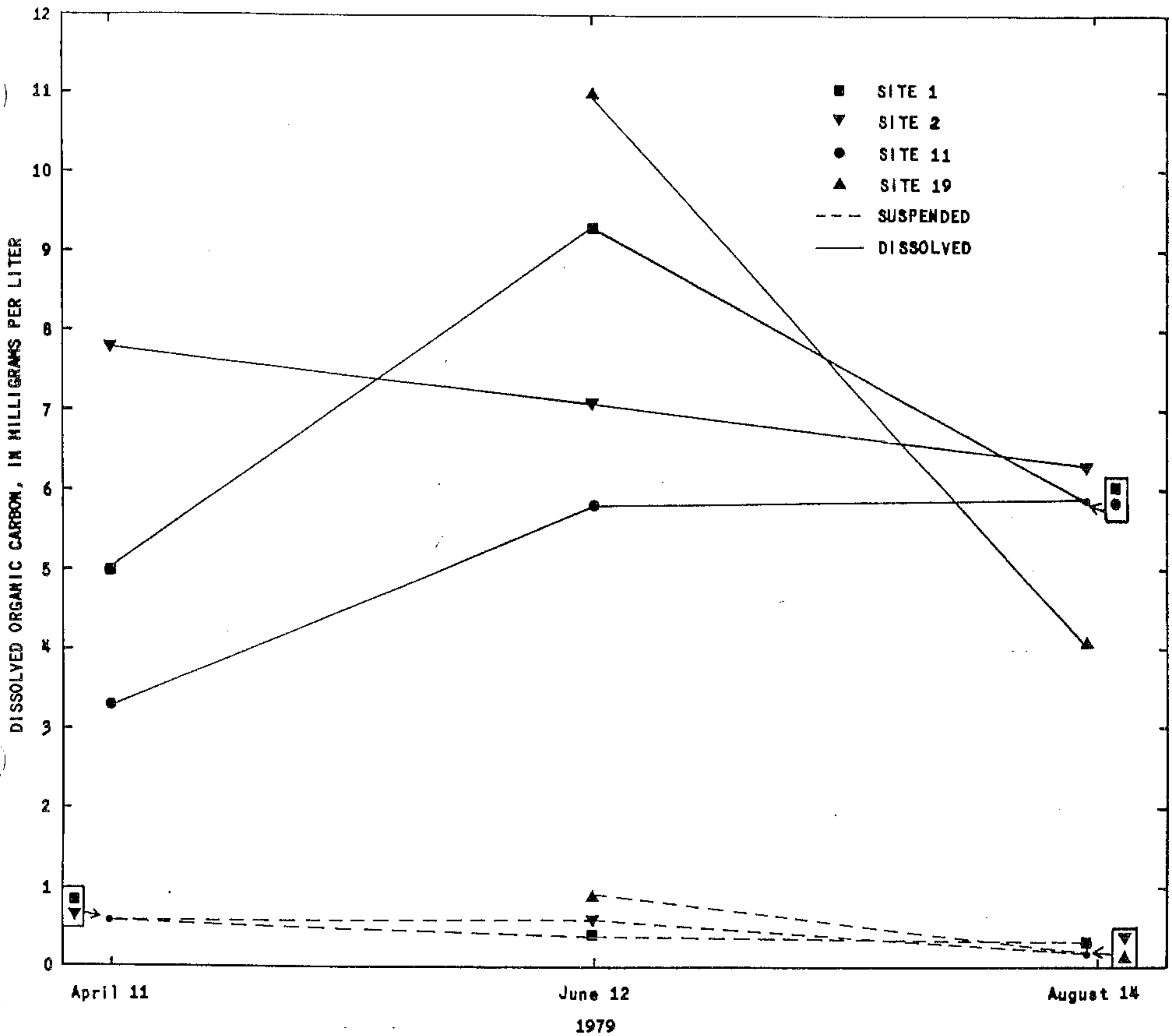


Figure 14.-- Seasonal distribution of dissolved- and suspended-organic carbon concentrations at selected sites in the Cypress Creek watershed.

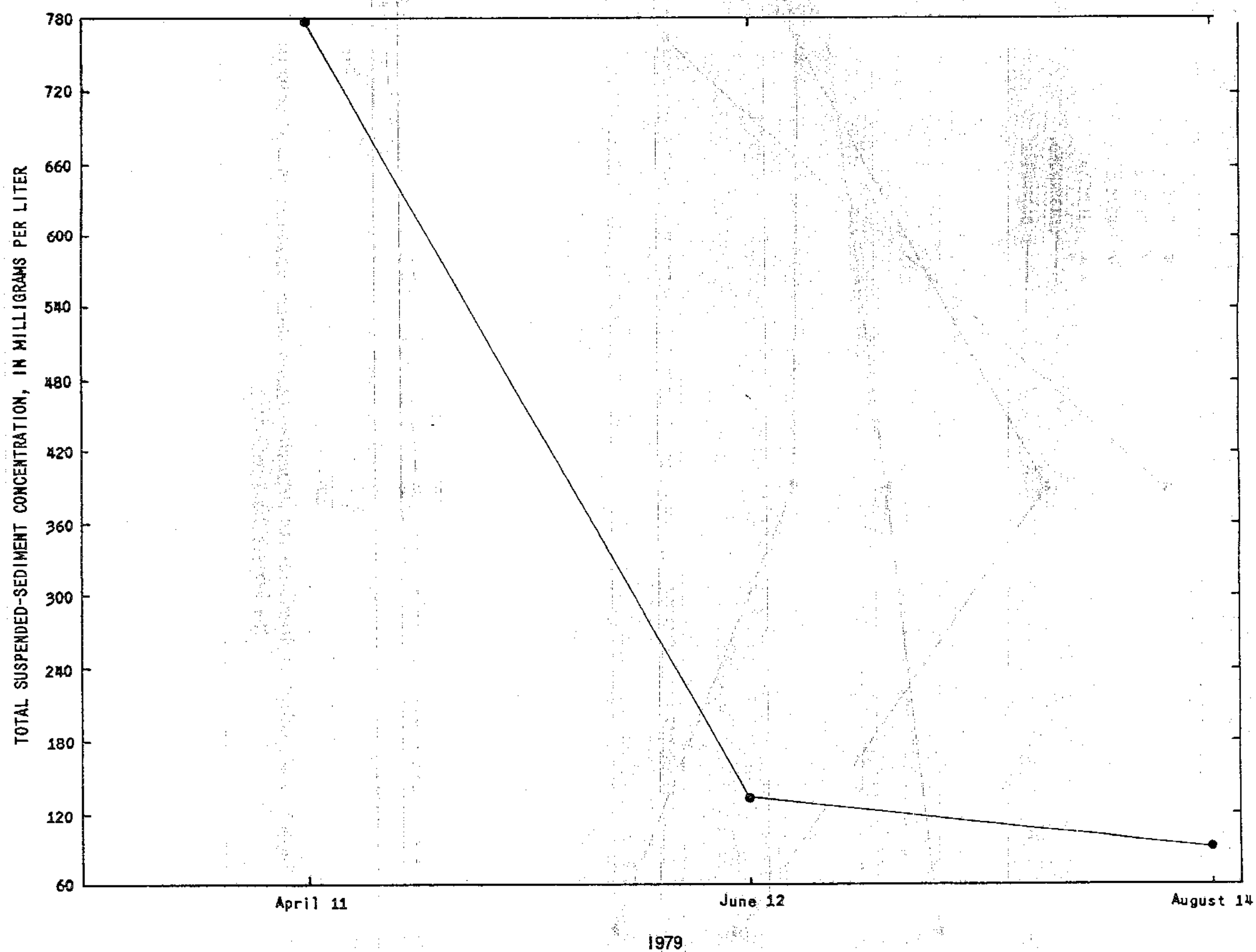


Figure 15.-- Trend of total suspended-sediment concentration for Cypress Creek.

Concentration of total organic carbon in water samples ranged from 3.6 to 11.9 mg/L, suspended organic carbon from 0.2 to 2.4 mg/L, and dissolved organic carbon from 3.3 to 11.9 mg/L (table 7). Organic carbon concentrations were highest in June 1979, a period of low flow. Seasonal distribution of dissolved organic carbon was apparent at Cypress Creek sites 1, 2, 11, and 19 (fig. 14). Most organic carbon concentrations were in the dissolved phase, except at tributary site 9, which had nearly equal concentrations in the dissolved and suspended phase (table 7). A water sample collected at site 19 on June 12, 1979, had the highest total organic carbon concentration.

Concentration of organic carbon in streambed samples ranged from 13 to 280 g/kg and that of total carbon from 20.1 to 280.3 g/kg (table 7). Highest concentrations of all organic constituents in streambed samples were detected at site 1. These concentrations decreased with distance downstream at sites 1, 2, 11, and 19. Total carbon concentration was least at background site 21 in June 1979.

Plant tissue is the original source of organic matter in soil, and animals are a secondary source (Brady, 1974, p. 137). Soil is a source of dissolved and suspended organic carbon in water. Consequently, organic matter in soil is a source of phosphorus and sulfur and virtually the sole source of nitrogen (Brady, 1974, p. 14). The organic matter of the soil also may influence the chemistry of manganese and other inorganic constituents in the streambed and water.

Chlorinated Hydrocarbons

Streambed samples, representing the most recently deposited sediment and associated chlorinated hydrocarbons, were collected at selected sites in April, June, July, and August 1979 for determination of aldrin, chlordane, DDD, DDE, DDT, dieldrin, endosulfan, endrin, heptachlor epoxide, heptachlor, lindane, mirex, or polychlorinated naphthalene (PCN), perthane, toxaphene and PCB's or polychlorinated biphenyls (table 8). Additionally, a core sample was collected on July 25, 1979, at site 11 at a depth of 2 ft into the stream bottom for determination of chlorinated hydrocarbon concentration. This sample represented long-term accumulations of chlorinated hydrocarbons. Chlordane, DDD, DDE , and PCB's were detected in the core sample (table 8). Most concentrations of PCB exceeded the 20-μg/kg water-quality alert limit (U.S. Environmental Protection Agency, 1976, p. 364), and concentrations of most constituents in the core sample were lower than the concentrations in the more recent sediment deposits.

Runoff from fields and lawns transports suspended and settleable solids and associated chlorinated hydrocarbons to Cypress Creek and its tributaries, where they are deposited. These deposits continue to move with the water flow and bring chlorinated hydrocarbon-bearing sediments into contact with chlorinated hydrocarbon-free sediments. This mixing provides strong adsorption sites for the chlorinated hydrocarbons and reduces their effective concentrations (Caro and Taylor, 1970, p. 6).

Chlorinated-hydrocarbon concentrations of streambed samples were determined because of (1) their potential harm to plant, animal, and human life; (2) their transport capabilities by adhering to suspended and settleable solids; and (3) their persistence in the natural environment for as long as 20 yr (Guenzi, 1974, p. 342; and Weimer and others, 1978, p. 2).

Insecticides.--Insecticides detected in streambed samples included chlordane, DDD, DDE, DDT, dieldrin, and heptachlor epoxide (table 8). Chlordane, an insecticide used for control of ants, termites, grasshoppers, and insects inhabiting soils, was detected at sites 1, 2, 5, 9, 11, 12, 19, and 21 of various samplings (table 8). Concentrations of chlordane at sites 2 and 19 for all samplings exceeded the 20-ug/kg water-quality alert limit set by the U.S. Environmental Protection Agency (1976, p. 240). All four tributary sites sampled contained detectable amounts of chlordane, and chlordane concentration at two of these sites (5 and 12) in June 1979 exceeded the water-quality alert limit set by the U.S. Environmental Protection Agency, 1976, p. 364). The tributary sites were all near farms and homes, where chlordane was probably used on adjacent cornfields and lawns.

Before 1972, DDT was used extensively for crop protection and disease control and was frequently detected in soils (Guenzi, 1974, p. 484). DDT is reduced to DDD and DDE residuals when incorporated into the soil (Guenzi, 1974, p. 137). Even though DDT was banned in 1972 (Hampel and Hawley, 1976, p. 76), DDT and it's reduced counterparts, DDD and DDE, were detected at sites 1, 2, 5, 11, 12, 19 and 21 on most sampling runs in 1979 (table 8). DDT concentrations at site 1 on July 25 exceeded the 20 ug/kg water-quality alert limit set by the U.S. Environmental Protection Agency (1976, p. 254).

At most sites in Cypress Creek where DDT was detected, DDD and (or) DDE were also detected; at most sites DDT concentrations were higher than DDD and DDE concentrations. DDD and DDE are byproducts in the reduction of DDT and, where detected, may indicate the use of an old supply of DDT on adjacent croplands.

Dieldrin, besides being the decomposition product of aldrin, is also an insecticide used extensively on cornfields. Dieldrin was detected at sites 1, 2, 5, 11, 12, 19, and 21 in various samplings (table 8). Dieldrin concentrations did not exceed the U.S. Environmental Protection Agency water-quality alert limits for any sampling period. Because aldrin was not detected, the presence of dieldrin was probably from applications of dieldrin on adjacent fields and not from the reduction of aldrin to dieldrin.

Heptachlor is a commercial component of chlordane, and heptachlor epoxide is the weathered product of heptachlor. Heptachlor is also an insecticide used to control soil mites, springtails, grasshoppers, and other soil inhabiting insects (Guenzi, 1974, p. 361). The detection of heptachlor epoxide at sites 1, 2, 11 and 19 in June and July 1979 (table 8) could be either from chlordane or heptachlor applications to adjacent fields.

Polychlorinated biphenyls (PCB's).--Because PCB's are chemically similar to certain chlorinated insecticides (Carey and Gowen, 1975) and are potentially harmful to plant, animal, and human life, PCB concentrations of streambed samples were determined. PCB's were detected at all sites on Cypress Creek (sites 1, 2, 11, and 19) and at two of four tributary sites (sites 5 and 9). PCB concentrations exceeded the 20 µg/kg water-quality alert limit set by the U.S. Environmental Protection Agency (1976, p. 364) at all four sampling sites in Cypress Creek in each sampling period; however, PCB concentrations were less than this limit at tributary sites 5 and 9 in June 1979 (table 8). PCB concentrations were highest at site 2 on State Highway 62 just downstream from the Boonville sewage-treatment plant (fig. 1).

Even though domestic PCB production was stopped in August 1977 and sale of products containing PCB's ceased 2 months later (Durfee, 1975), PCB's will continue to be found in the hydrologic environment because of (1) their 20- to 30-yr persistence after introduction into the environment; (2) the long life of manufactured products containing PCB's, and (3) imported items containing PCB's still being sold in the United States (Weimer and others, 1978). Because PCB's were also used widely before 1971, the exact source of PCB's in Cypress Creek and its two tributaries would be difficult to identify. However, PCB's can enter the hydrologic environment from (1) runoff of sewage sludges disposed of on land, (2) industrial and municipal waste discharge, (3) accidental spills, (4) improper waste-disposal practices, and (5) formerly as ingredients of insecticides or as carriers for insecticides (Dennis, 1975).

The upper reaches of Cypress Creek, upstream from site 1, flow adjacent to a coal-mine waste slurry, where equipment containing PCB's could have been used and which could have been an early PCB source for Cypress Creek. However, the high PCB concentrations continually detected at site 2 possibly indicate an additional PCB source at this site. The much lower PCB concentrations at downstream sites 11 and 19 than at site 2 indicate that the PCB sources are probably being transported from an upstream location rather than entering the stream at the site. High suspended-sediment concentrations observed during the high flow of the April 1979 sampling period would transport attached PCB's through the hydrologic system (table 9). PCB particles would be deposited later as flow conditions returned to normal.

Because several carp and fishermen were noted at various locations (including site 11) along Cypress Creek in June 1979, PCB's in Cypress Creek could affect both fish and man. PCB's are potentially harmful to human beings and could easily be incorporated into the biological food chain by fish. PCB's seek out and accumulate in fatty tissue in fish and animals, and fish are slow in eliminating PCB's from their system (Weimer and others, 1978, p. 3).

PCB concentrations of streambed samples collected at tributary sites 5, 9, 12, and 21 in June 1979 were 12, 10, and 0 µg/kg, respectively. The tributary sites were sampled only one time for PCB's. During high flow, the tributaries could also transport PCB's into Cypress Creek by PCB adherence to suspended and settleable solids.

Suspended Sediment

Suspended-sediment concentration ranged from 13 to 362 mg/L at Cypress Creek sites in April and June 1979 and from 15 to 78 mg/L at the tributary sites in June 1979 (table 9). Total suspended-sediment concentration for Cypress Creek ranged from 91 mg/L (August 14, 1979) to 776 mg/L (April 11 and 12, 1979).

Suspended-sediment samples collected for Cypress Creek on August 14, 1979, were composited for determination of total concentration. A sieve analysis of the composited sample was done to determine particle size of the suspended material. The analysis (table 10) indicated that the particles being transported downstream in Cypress Creek during low flow on August 14, 1979, were 96 percent silt and clay size and 4 percent sand size. According to Kennedy (1965, p. D26), the exchange capacity of stream sediments acts as a stabilizing influence on the chemical quality of streams and may be an important factor in the fluvial transport of cations.

Core samples collected at various depths in Cypress Creek and analyzed by the U.S. Soil Conservation Service indicated that the streambed was chiefly silt and clay but contained some medium-sized sand particles. The plastic-like clay was a consistent combination of grey, red, and brown colors (Robert Rasely, U.S. Soil Conservation Service, oral commun., June 1979) that were also characteristic of the surface streambed material throughout Cypress Creek. Highest suspended-sediment concentrations were detected during periods of high flow (figs. 15, 16, and 17) in April 1979. A thunderstorm early on April 12, 1979, before the sampling of downstream sites 11 and 19, caused a significant increase in the suspended-sediment concentration. However, concentrations at upstream sites 1 and 2 were higher in April 1979 than in June 1979 because of high flow in April 1979 at these sites, owing to intermittent rains before sampling (figs. 3 and 5). Relation of suspended-sediment concentration and streamflow for Cypress Creek is presented in figure 17.

Erosion of adjacent fields and of banks and the silt streambed material observed during sampling probably accounts for the high suspended sediment concentrations detected during periods of intense rainfall and high streamflow (Colby, 1956 p. 83).

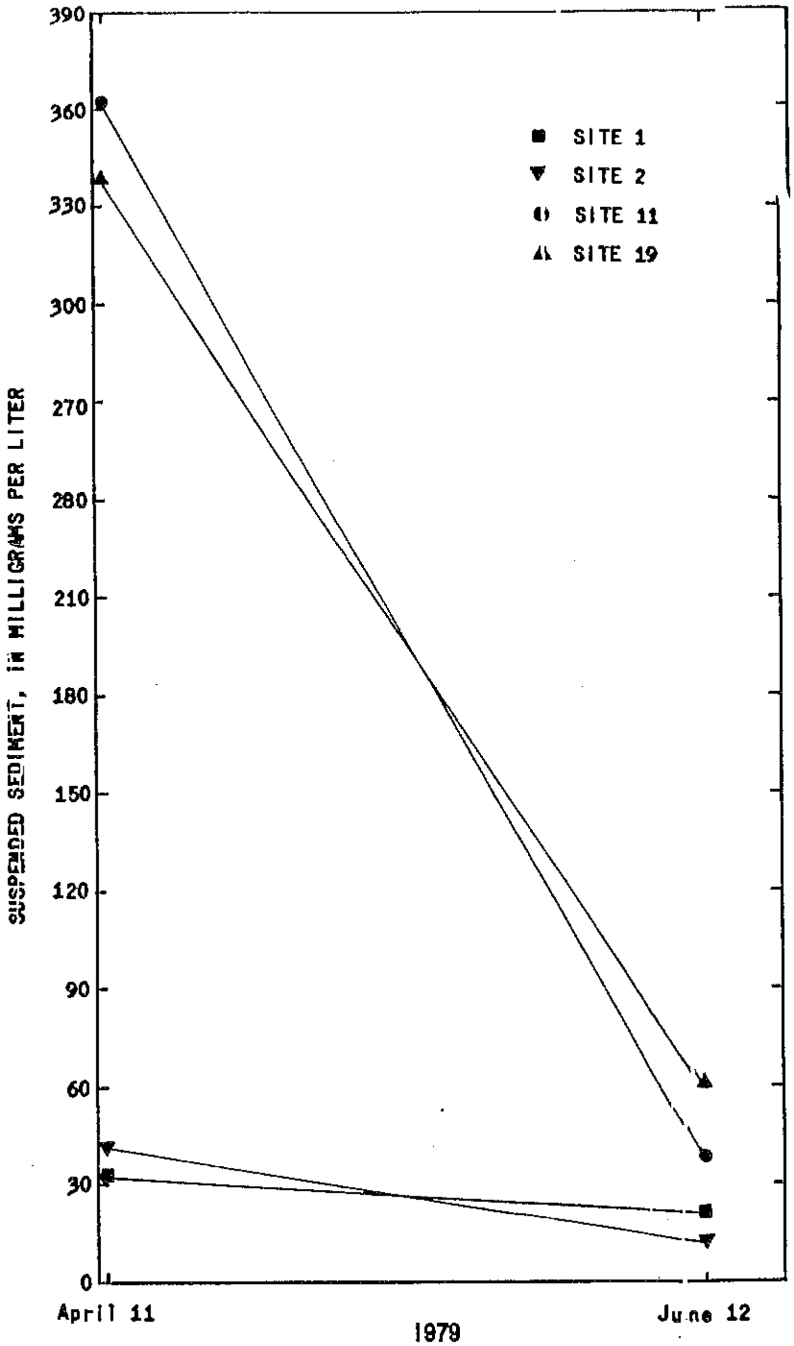


Figure 16.-- Trends of suspended-sediment concentration at selected sites in the Cypress Creek watershed.

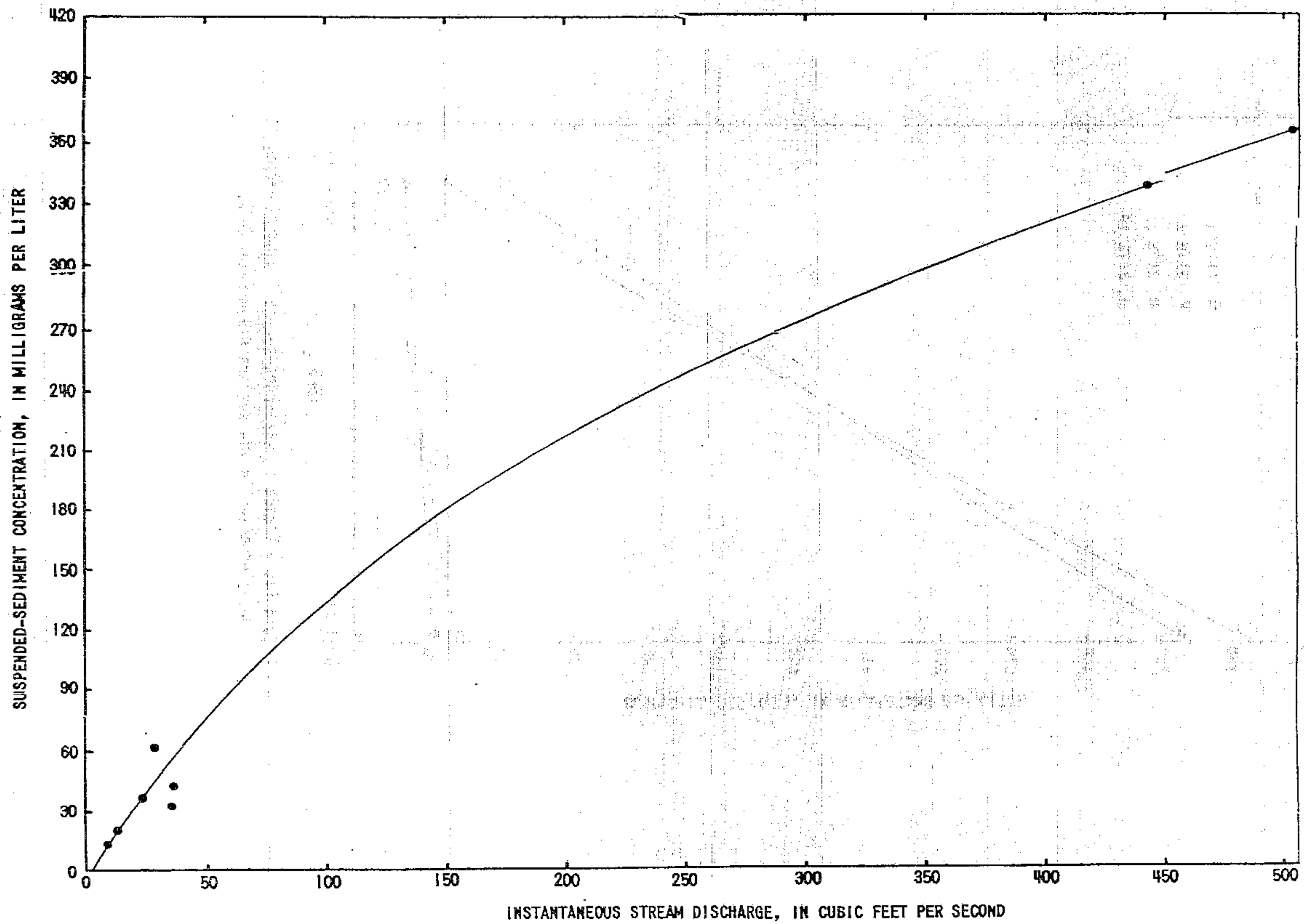


Figure 17.-- Relation of stream discharge and suspended-sediment concentration in the Cypress Creek watershed.

Microbiological and Biological Data

Microbiological and biological data collected with chemical data can help define the water quality of streams. Samples were collected for identification and enumeration of bacteria, benthic invertebrates, and periphyton. Bacteria are transient communities reflective of stream conditions only at the time of sample collection, whereas periphyton and benthic invertebrates are resident communities indicative of long-term water-quality trends.

Artificial multiplates were placed at selected sites for the colonization of benthic invertebrates. These multiplates were either washed away or were buried with sediment in one of several intense storms. An Ekman grab was used in July and August 1979 to attempt collection of a representative benthic invertebrate community, but streamflow was too swift and dredging was unsuccessful in July 1979. No benthic invertebrates were detected at lower flow conditions in August 1979 at sites 1 and 19 where sampling was attempted again. The lack of benthic invertebrates in the grab samples may have been due to previous flooding of Cypress Creek prior to sampling.

Bacteria

Water samples were collected for the determination of fecal coliform and fecal streptococcal bacteria concentrations at sites 1, 2, 11, and 19 on April 10 and June 11, 1979; at sites 2, 11, and 19 on August 13, 1979; and at sites 5, 9, 12, and 21 on June 11, 1979 (table 11). Population of fecal coliform bacteria ranged from 20 to 27,200 col/100 mL (colonies per 100 milliliters) and that of fecal streptococcal bacteria from 113 to 3,310 col/100 mL.

Ratios of fecal coliform to fecal streptococci (FC/FS) can be used to define bacteria as either human or animal waste. Contamination by human fecal material is indicated by a FC/FS ratio greater than 4, and contamination by animal fecal material is indicated by a FC/FS ratio less than 1 (Geldreich, 1966). Ratios between 1 and 4 indicate a combination of human and animal waste. Ratios may also be affected by differential die-off rates.

FC/FS ratios for site 2 in June and August 1979 indicated human waste contamination, probably owing to the Boonville sewage-treatment plant upstream from site 2. In April 1979, a combination of human and animal waste was indicated by FC/FS ratios for site 2, possibly owing to differential die-off rates or dilution caused by high flow (fig. 5). FC/FS ratios at site 1 consistently indicated a combination of human and animal waste, probably because of residences and animal life immediately upstream from the site. FC/FS ratios at sites 11 and 19, the two farthest downstream Cypress Creek

sites,varied widely in the study. At high flow in April 1979, ratios at both sites indicated a combination of human and animal waste. At low flow in June 1979, ratios at both sites indicated human waste, and at low flow in August 1979 ratios at both sites indicated animal waste.

Of the four tributary sites sampled in June 1979, FC/FS ratios indicated animal waste at sites 5, 12, and 21 and a combination of human and animal waste at site 9. Home septic systems along the tributary may have caused the high ratio at site 9. A pig feedlot immediately downstream from tributary site 21 probably accounts for the low ratio that indicates animal waste contamination at that site.

Periphyton

Periphyton are resident communities of microscopic aquatic plants and animals that grow in a fixed, submerged substrate of a stream and are a long-term water-quality indicator of stream conditions. Mylar strips for the colonization of periphyton were placed along Cypress Creek at sites 1, 2, 11, and 19 on June 13, 1979, and were collected on August 14, 1979. Unfortunately, the strips at sites 11 and 19 were lost in one of the floodings during the colonization period. Only Chrysophyta (yellow-brown algae diatoms) organisms were detected at sites 1 and 2 (table 12). Dominant organisms at sites 1 and 2 were Nitzschia, and Navicula and Nitzschia, respectively. These widely distributed organisms inhabit all types of water; however, certain species of Navicula and Nitzschia are characteristic of streams affected by sewage. Site 2, downstream from the Boonville sewage-treatment plant, is occasionally affected by human waste, as indicated by the FC/FS ratio (table 11). Information on the species of Navicula and Nitzschia is sparse because only a qualitative analysis of the samples was done to identify the algal part of the periphyton.

Diversity seems to be low at both sites 1 and 2; however, the intense rainfall and corresponding high flow and flooding, increased suspended-sediment loads, and increased discharge (fig. 17) probably account for the low variety of organisms at each site. Biomass was 4.21 g/m^2 (grams per square meter) at site 1 and 2.19 g/m^2 at site 2 (table 12). A lower biomass was detected at site 2, which had correspondingly higher suspended-sediment loads and stream discharge during high flow and floods than site 1 (figs. 5, 16, and 17).

Coal-Mine Drainage

In its north reaches, Cypress Creek is directly affected by a coal-mine waste slurry that feeds tributaries, such as the one at site 1G (pH = 1.2), which drain into the creek during intense rainfall. At high flow, drainage from these low-pH tributaries seems to lower alkalinity concentrations (table 4) and pH values (table 2) in the upper reaches of the creek at sites 1 and 2 and to raise specific conductance (fig. 6), dissolved-solids concentration, and hardness, possibly owing to a flushing of materials from these tributaries (table 4 and fig. 9). However, during high-flow, concentrations of all these properties at downstream-sites 11 and 19 show dilution effects. Drainage area and streamflow are significantly greater at sites 11 and 19 than at upstream sites 1 and 2, and these factors may account for the dilution effects.

Most of the tributaries drain active or reclaimed surface coal-mine lands that affect Cypress Creek. Concentrations of major ions and related constituents in the June 1979 sampling period (tables 2 and 4) were maximum for all the samplings in the study and were the highest in these tributaries. Direct and indirect effects from present and past surface coal-mining operations probably account for the higher major ion concentrations detected in Cypress Creek and tributary sites 5, 9, and 12, than at background site 21.

The general water type of the watershed was calcium and magnesium sulfate, which was characteristic of streams affected by past or present surface coal-mining operations in the Busseron Creek watershed (Eikenberry, 1978). As illustrated by Stiff (1951) patterns in figure 7 and 8, water samples collected at background site 21 (unaffected by past or present surface coal-mining operations) contained the lowest concentrations of the major ions as compared to Cypress Creek (fig. 7) and the other tributary sites (fig. 8). The water type at site 21 was calcium sulfate.

Sewage

Site 2 on Cypress Creek is near Highway 62, just south of the Boonville sewage-treatment plant (fig. 1). This site had the highest FC/FS ratio and fecal coliform population in the watershed. The FC/FS ratios at the site in June and August 1979 indicated human-waste contamination (table 11). High flow in April 1979 seemed to cause either a dilution effect or a differential die-off of fecal coliform. *Navicula* and *Nitzschia* were the dominant periphyton genera at site 2. Certain species of these genera are characteristic of sewage-affected water.

Ammonia concentrations exceeded 0.10 mg/L (as nitrogen) for all samplings. These concentrations commonly indicate sewage or industrial contamination (National Academy of Sciences and the National Academy of Engineering, 1972, p. 55). Generally, nutrient concentrations of both water and streambed samples were highest at site 2 (table 5), which indicates effects of sewage on the creek at this site.

Chlorinated Hydrocarbons

Concentrations of chlordane and DDT detected in streambed samples at some sites exceeded the 20-Ug/kg water-quality alert limit set by the U.S. Environmental Protection Agency (1976, p. 240 and 254). Concentration of PCB's at all Cypress Creek sampling sites for all sampling periods (table 8) exceeded the 20-Ug/kg water-quality alert limit set by the U.S. Environmental Protection Agency (1976, p. 364). The highest PCB concentrations were at site 2 for all sampling periods.

Analysis of a core sample taken 2 ft into the streambed at site 11 on July 25, 1979, detected chlordane, DDD, DDE, and PCB's. The PCB concentration exceeded the water-quality alert limit of 20 Ug/kg. Because the concentrations of these constituents in the core sample is indicative of accumulations of chlorinated hydrocarbons over a period of time, further use of these chlorinated hydrocarbons could cause problems.

Suspended Sediment

Erosion of fields and embankments adjacent to Cypress Creek and of the silt streambed material of the creek probably accounts for high suspended-sediment concentrations of the creek during periods of high flow (fig. 17). Inadequate drainage and restriction of flow in the lower reaches of Cypress Creek cause backwaters from the Ohio River to as far north as site 19 in Cypress Creek, as well as flooding and increased erosion of adjacent banks and high suspended-sediment loads at these times.

The erosion of fields adjacent to Cypress Creek and of its banks can introduce chlorinated hydrocarbons into the creek, and increased suspended-sediment concentrations can act as a transport mechanism for these hydrocarbons. Other soil constituents (nitrogen, phosphorus, aluminum, iron, and manganese) may also be transported with or on material suspended in water during high flow and periods of high suspended-sediment loads. A sieve analysis of suspended-sediment samples collected on August 14, 1979, indicated

that particles being transported downstream in Cypress Creek were 96 percent silt and clay size and 4 percent sand size. According to Kennedy (1965, p. D26), the exchange capacity of stream sediments acts as a stabilizing influence on the chemical quality of streams and may be an important factor in the fluvial transport of cations.

SUMMARY

A water-quality survey of the Cypress Creek watershed, Warrick County, was made by the Geological Survey from March to August 1979 to provide the U.S. Soil Conservation Service with water-quality data needed for preparing an environmental evaluation of the watershed before alternatives can be devised to (1) improve water quality, (2) minimize flooding, (3) reduce sedimentation, and (4) provide adequate outlets for drainage. Alternatives to the Watershed Protection and Flood Prevention Act (Public Law 566, 83d Congress) may also be devised to improve water-quality conditions (Robert Rasely, Soil Conservation Service, oral commun., May 1, 1980).

Water type for Cypress Creek was calcium and magnesium sulfate; that for tributary sites 9 and 12 was magnesium sulfate; that for tributary site 5 was calcium and magnesium sulfate; and that for background tributary site 21 was calcium sulfate. Sources of these ions are probably the soil and past and present surface coal-mining operations.

Highest concentrations of the major ions and dissolved solids and values of hardness and of specific conductance were detected at the tributary sites affected by either past or present surface coal-mining operations. The lowest pH in the watershed, 1.2, was detected at tributary site 1G. The pH values in Cypress Creek were lower during periods of high flow (March, April and July 1979) than during low flow (June and August 1979) when low-pH tributaries drained from the coal-mine waste slurry into Cypress Creek. This drainage correspondingly lowered the alkalinity of the creek. Increases of specific conductance, dissolved-solids concentration, and hardness were also detected at upstream sites 1 and 2 during high flow; however, most of these properties decreased downstream because flow increases downstream as the drainage area increases. Concentrations of most constituents in Cypress Creek are still much greater than concentrations at background site 21.

Ammonia concentrations at all sampling sites, except background site 21, exceeded 0.10 mg/L (as nitrogen). These concentrations in surface water generally indicate sewage or industrial contamination. Concentrations of phosphorus and phosphate in water at sites 2 and 9 in June 1979 exceeded 0.10 mg/L (as phosphorus). Concentrations greater than 0.10 mg/L may cause plant nuisances in flowing water.

Concentrations of chlordane and DDT in streambed samples from selected sites exceeded water-quality alert limits set by the U.S. Environmental Protection Agency, and PCB concentrations exceeded the limit for PCB's at Cypress Creek sites 1, 2, 11, and 19 for all sampling periods. The highest PCB concentration was at site 2. Chlorinated-hydrocarbon concentrations were lower at the tributary sites than at Cypress Creek sites. Chlordane, DDD, DDE, and PCB's were detected in a core sample collected at a depth of 2 ft into the streambed at site 11 on July 25, 1979. The PCB concentration exceeded the Environmental Protection Agency water-quality alert limit.

Concentrations of ammonia as nitrogen, nitrogen as nitrogen , nitrite plus nitrate as nitrogen, and organic carbon varied seasonally. Dissolved and total iron, manganese, and sulfate concentrations in water at selected sites in the watershed exceeded limits set by the Environmental Protection Agency for domestic water supplies. Manganese did not follow any seasonal trends but did follow the same trend as suspended-sediment concentrations at sites 1 and 2, where both decreased in subsequent samplings from April to August 1979. Organic-carbon concentrations varied seasonally in Cypress Creek, and highest organic-carbon concentrations of both water and streambed samples were detected at site 1.

In Cypress Creek, suspended-sediment concentration increased and specific conductance, hardness, and concentrations of major ions and dissolved solids decreased as streamflow increased. Alkalinity concentrations and pH were lower in Cypress Creek during periods of high flow in March, April, and July 1979 than during low flow in June and August 1979. A decrease in specific conductance values was detected at most tributary sites during the high flow of March, April, and July 1979.

Highest total suspended-sediment concentration was detected in April 1979, a period of high flow, and the lowest in August 1979, a period of low flow. A sieve analysis of the samples collected on August 14, 1979, indicated that particles being transported in Cypress Creek were 96 percent silt and clay size and 4 percent sand size.

Ratios of FC/FS indicated human waste at site 2 on June 11 and August 13, 1979, and at sites 11 and 19 on June 11, 1979. All sites are downstream from the Boonville sewage-treatment plant. Sites affected by both human and other animal waste were 1, 2, 11, and 19 in April 1979 and 1 and 9 in June 1979.

Chrysophytan organisms were detected on mylar strips placed at sites 1 and 2 for colonization of periphyton. Dominant organisms at sites 1 and 2 were *Nitzschia*, and *Navicula* and *Nitzschia*, respectively. Low populations and lower biomass at sites 1 and 2 were probably due to scouring of the mylar strips by increased suspended-sediment loads during the high flow and flooding.

Generally, water quality of the Cypress Creek watershed is affected by (1) past and present surface coal-mining operations; (2) sewage, possibly from the Boonville sewage-treatment plant and home septic-tank systems; (3) erosion; (4) high suspended-sediment loads during high flow; (5) high PCB and chlordane concentrations in the streambed; and (6) floods and backwaters from the Ohio River during periods of intense rainfall and high streamflow.

REFERENCES

Brady, N. C., 1974, The nature and properties of soils (8th ed.): New York, MacMillan Publishing Co., Inc., 639 p.

Brown, Eugene, Skougstad, M. W., and Fishman, M. J., 1970, Methods for collection and analysis of water samples for dissolved minerals and gases: U.S. Geological Survey Techniques of Water-Resources Investigations, Book 5, Chapter A1, 160 p.

Carey, A. E., and Gowen, J. A., 1975, PCB's in agricultural and urban soil, in National Conference on Polychlorinated Biphenyls, Chicago, Ill., Nov. 19-21, 1975, Proceedings: U.S. Environmental Protection Agency, Office of Toxic Substances, p. 195-198.

Caro, J. H., and Taylor, A. W., 1970, Pathways of loss of dieldrin from soils under field conditions: American Chemical Society, Division of Pesticide Chemistry, 160th Meeting, September 1970, Chicago, Ill., 6 p.

Carter, R. W., and Davidian, Jacob, 1968, General procedure for gaging streams: U.S. Geological Survey Techniques of Water-Resources Investigations Book 3, Chapter A6, 13 p.

Colby, B. R., 1956, Relationship of sediment discharge to streamflow: U.S. Geological Survey open-file report, 170 p.

Dennis, S. D., 1975, Polychlorinated biphenyls in the surface waters and bottom sediments of the major drainage basins of the United States, in National Conference on Polychlorinated Biphyenyls, Chicago, Ill., Nov. 19-21, 1975, Proceedings: U.S. Environmental Protection Agency, Office of Toxic Substances, p. 183-193.

Durfee, R. L., 1976, Production and usage of PCB's in the United States, in National Conference on Polychlorinated Biphenyls, Chicago, Ill., Nov. 19-21, 1975, Proceedings: U.S. Environmental Protection Agency, Office of Toxic Substances, p. 103-107.

Eikenberry, S. E., 1978, A water-quality assessment of the Busseron Creek watershed, Sullivan, Vigo, Greene, and Clay Counties, Indiana: U.S. Geological Survey Open-File Report 78-13, 36 p.

Feth, J. H., 1966, Nitrogen compounds in natural water--a review: Water Resources Research, v. 2, no. 1., 41 p.

Geldreich, E. E., 1966, Sanitary significance of fecal coliforms in the environment: U.S. Department of Interior, Federal Water Pollution Control Administration Publication WR-20-3.

Goerlitz, D. F., and Brown, Eugene, 1972, Methods for analysis of organic substances in water: U.S. Geological Survey Techniques of Water-Resources Investigations, Book 5, Chapter A3, 40 p.

Gray, H. H., Wayne, W. J., and Wier, C. E., 1970, Geologic map of 1°x2° Vincennes quadrangle and parts of adjoining quadrangles, Indiana and Illinois, showing bedrock and unconsolidated deposits: Indiana Department of Natural Resources, Geological Survey Division.

Greeson, P. E., Ehlke, T. A., Irwin, G. A., Lium, B. W., Slack, K. V., 1977, Methods for collection and analysis of aquatic biological and microbiological samples: U.S. Geological Survey Techniques of Water-Resources Investigations, Book 5, Chapter A4, 332 p.

Guenzi, W. D., ed., 1974, Pesticides in soil and water: Madison, Wis., Soil Science Society of America, Inc., 562 p.

Guy H. P., 1970, Fluvial sediment concepts: U.S. Geological Survey Techniques of Water-Resources Investigations, Book 3, Chapter C1, 55 p.

Guy, H. P., and Norman, V. W., 1970, Field methods for measurement of fluvial sediment: U.S. Geological Survey Techniques of Water-Resources Investigations, Book 3, Chapter C2, 59 p.

Hampel, C. A., and Hawley, G. G., 1976, Glossary of chemical terms: New York, Van Nostrand-Reinhold Co., 281 p.

Hem, J. D., 1964, Deposition and solution of manganese oxides: U.S. Geological Survey Water-Supply Paper 1667-B, 42 p.

______ 1970, Study and interpretation of the chemical characteristics of natural water: U.S. Geological Survey Water-Supply Paper 1473, 363 p.

Hoggatt, R. E., 1962, Drainage areas of Indiana streams: Indiana Department of Natural Resources, 231 p.

Kennedy, V. C., 1965, Mineralogy and cation-exchange capacity of sediments from selected streams: U.S. Geological Survey Professional Paper 433-D, 28 p.

McCarty, P. L., Echelberger, W. F., Hem, J. D., and others, 1968, Chemistry of nitrogen and phosphorus in water, Committee report: Journal of the American Water Works Association, v. 62, p. 127-144.

National Academy of Sciences and the National Academy of Engineering, 1972 [1974], Water-quality criteria, 1972: Washington, D.C., U.S. Government Printing Office, 594 p.

National Oceanic and Atmospheric Administration, 1979, Climatological data for Indiana: National Oceanic and Atmospheric Administraton, Environmental Data Service, v. 84, no. 1-8, 18 p.

Oborn, E. T., 1964, Intracellular and extracellular concentrations of manganese and other elements by aquatic organisms: U.S. Geological Survey Water- Supply Paper 1667-C, 18 p.

Schneider, A. F., 1966, Physiography, <u>in</u> A. A. Lindsey, ed., Natural features of Indiana: Indiana Academy of Science, p. 40-56.

Shively, J. L., 1979, Soil survey of Warrick County: U.S. Department of Agriculture, Soil Conservation Service, in cooperation with Purdue University Agricultural Experiment Station, 135 p.

Skougstad, M. W., Fishman, M. J., Friedman, L. C., Erdman, D. E., and Duncan, S. S., eds., 1979, Methods for determination of inorganic substances in water and fluvial sediments: U.S. Geological Survey Techniques of Water-Resources Investigations, Book 5, Chapter A1, 626 p.

Stiff, H. A., Jr., 1951, The interpretation of chemical water analysis by means of patterns: Journal of Petroleum Technology, v. 3, no. 10, p. 15-17.

Thomas, G. W., 1970, Soil and climatic factors which affect nutrient mobility, <u>in</u> Nutrient mobility in soils: Accumulation and losses: Soil Science Society of America Special Publication Series no. 4, p. 1-20.

U.S. Environmental Protection Agency, 1976, Quality criteria for water: U.S. Environmental Protection Agency, EPA-440/9-76-023, 501 p. (NTIS Publication PB-263-943.)

Weimer, Linda, Downs, Warren, Manson, Kathy, and Smith, Peyton, 1978, The ABC's of PCB's: Madison, University of Wisconsin, Public Information Report, WIS-SG-76-125, 5 p.

Zajicek, O. T., and Pojasek, R. B., 1976, Fulvic acid and aquatic manganese transport: Water Resources Research, v. 12, no. 2, p. 305-308.

Tables 1-12

Table 1.--Locations of sampling sites plotted in figures 1 and 2, Cypress Creek watershed

[Trib, tributary; Rd., road; RR, railroad track; N., north; W., west, S., South, NE., northeast]

Site	Location
1A	Cypress Creek at 400 N. Rd. north of Boonville.
1B	Cypress Creek at 300 W. Rd. before lake.
1C	Trib north of 300 W. Rd. and 400 N. Rd. intersection.
1D	Trib at 500 N. Rd.
1E	Trib at 500 N. Rd.
$1E_1$	Trib to 1E, east side.
$1E_2$	Trib to 1E, west side.
1F	Trib at 400 N. Rd., east of 400 N. Rd. and 300 W. Rd. intersection.
1G	Acid trib, NE. of site 1.
1	Cypress Creek at North St., north of Boonville.
2	Cypress Creek at State Highway 62, south of sewage-treatment plant.
3	Carter-Traylor ditch at State Highway 62.
5	Trib at old State Highway 61, south of Boonville.
5A	Trib to Arm A, northern sector.
5B	Trib to Arm A, at city lake outlet.
5C	Trib to Arm B, southern sector.
5D	Trib to Arm B, northern sector.
6	Trib at new State Highway 61, west of site 5.
7	Cypress Creek at 150 S. Rd.
9	Trib at 350 W. Rd.
10	Kelly ditch at State Highway 261.
11	Cypress Creek at 300 S. Rd near RR.
12	McCool ditch at Friendship Church on 350 W. Rd.
13A	Trib arm to McCool ditch east of Wright mine at old State Highway 61.
13B	Trib arm to McCool ditch on old State Highway 61 north of 300 S. Rd.
14	Trib arm to McCool ditch at 350 S. Rd.
14C	Trib arm to Taylor ditch at 350 S. Rd.
14D	Trib arm to Taylor ditch at old State Highway 61, north of 500 S. Rd.
14E	Trib arm to Taylor ditch at 500 S. Rd.
15	Cypress Creek.
16	Trib to Cypress Creek at 450 W. Rd.
17	Cypress Creek at 450 S. Rd.
18	Kaiser ditch at new State Highway 61 and 500 S. Rd.
19	Cypress Creek at 550 S. Rd. west of Dayville.
20	Cypress Creek.
21	Summer Pecka ditch at 450 S. Rd.
22	Cypress Creek at 550 W. Rd.
23	Cypress Creek at State Highway 66.
26	Taylor ditch at new State Highway 61.
26A	Trib arm to Koehler ditch at 550 S. Rd.
27	Cypress Creek trib at 475 W. Rd.

Table 2.--Field measurements at sites along Cypress Creek in April, June, July, and August 1979

[Measurements by U.S. Geological Survey; °C, degree Celsius; µmho/cm, micromho per centimeter; ft^3/s, cubic foot per second]

Site	1	2	7	11	15	17	19
April 1979							
Sampling date (1979)	April 11	April 11	April 10	April 12	April 10	April 10	April 12
Time (eastern standard)	1105	[1]1440	1550	1000	1630	1725	1805
Water temperature (°C)	11.1	14.0	11.0	13.5	10.7	10.6	18.4
Air temperature (°C)	--------	--------	9.5	--------	9.6	9.6	--------
pH	6.6	7.2	6.9	7.1	7.1	7.2	7.4
Eh, oxidation-reduction potential (millivolts)	+305	+250	+260	+320	+255	+380	+410
Specific conductance (µmho/cm at 25°C)	1,050	1,000	1,150	705	1,300	1,300	940
Dissolved oxygen (mg/L)	11.4	15.6	11.0	9.6	11.3	11.2	9.5
Dissolved oxygen (percent saturation)	105	153	101	93	103	102	102
Instantaneous stream discharge (ft^3/s)	36.2	36.7	--------	505	--------	--------	443
Weather	Overcast, intermittent rain, and warm						
June 1979							
Sampling date (1979)	June 12	June 12	June 13	June 12	June 13	June 13	June 12
Time (eastern standard)	1855	1610	1415	1513	1425	1510	1045
Water temperature (°C)	25.2	25.8	27.4	27.1	27.0	27.1	24.0
Air temperature (°C)	24.5	26.0	29.0	31.1	29.0	31.0	28.0
pH	7.1	7.0	7.7	7.0	8.8	7.8	6.4
Specific conductance (µmho/cm at 25°C)	1,600	1,560	2,000	1,800	2,120	2,110	1,900
Dissolved oxygen (mg/L)	3.8	9.7	7.6	8.1	7.8	9.6	9.0

Table 2.--Field measurements at sites along Cypress Creek in April, June, July, and August 1979--Continued

Site	1	2	7	11	15	17	19
June 1979--Continued							
Dissolved oxygen (percent saturation)	45	118	95	100	96	118	106
Instantaneous stream discharge (ft^3/s)	13.2	11.1	--------	23.2	--------	--------	28.1
Weather	Hot, humid, and sunny						
July 25, 1979							
Time (eastern standard)	0950	1040	1316	1110	1350	1410	1155
Water temperature (°C)	25.0	24.8	24.5	24.0	24.5	24.6	24.0
Air temperature (°C)	--------	--------	--------	--------	--------	--------	--------
pH	6.4	6.8	7.0	6.7	6.9	7.0	6.8
Eh, oxidation-reduction potential (millivolts)	+310	+263	+240	+265	+240	+245	+245
Specific conductance (μmho/cm at 25°C)	2,100	1,750	1,500	1,300	1,400	1,400	1,200
Dissolved oxygen (mg/L)	6.4	6.1	5.1	4.8	5.6	5.7	5.4
Dissolved oxygen (percent saturation)	75	72	59	55	65	66	62
Estimated stream discharge (ft^3/s)	[2]29	[2]19	[2]48	[2]70	[2]106	[2]64	[2]160
Weather	Intermittent light showers and overcast						

Table 2.--Field measurements at sites along Cypress Creek in April, June, July, and August 1979--Continued

Site	1	2	7	11	15	17	19
July 26, 1979							
Time (eastern standard)	1157	1200	---	1210	---	---	1215
pH	7.0	6.6	---	7.2	---	---	7.1
Eh, oxidation-reduction potential (millivolts)	+350	+280	---	+310	---	---	+285
Specific conductance (umho/cm at 25°C)	1,200	1,100	---	650	---	---	470
Estimated stream discharge (ft^3/s)	[2]493	[2]440	---	[2]1,100	---	---	[2]2,300
Weather	Heavy rain[3]						
August 13, 14, 1979							
Sampling date (1979)	Aug. 14	Aug. 14	Aug. 13	Aug. 14	Aug. 13	Aug. 13	Aug. 14
Time (eastern standard)	1600	1410	1550	1205	1615	1626	0950
Water temperature (°C)	25.0	25.8	27.5	24.4	27.2	27.0	22.5
pH	7.4	7.6	8.0	8.0	8.0	7.8	7.5
Eh, oxidation-reduction potential (millivolts)	+210	+340	+340	+392	+335	+345	+480
Specific conductance (umho/cm at 25°C)	1,300	1,180	2,100	1,500	2,200	2,120	1,600
Dissolved oxygen (mg/L)	7.9	7.7	12.4	9.4	11.2	9.8	7.6
Dissolved oxygen (percent saturation)	93	92	153	109	137	120	85
Instantaneous stream discharge (ft^3/s)	6.07	4.26	--------	11.97	--------	--------	13.13
Weather	Warm and partly cloudy						

[1]For example, 1440 is 2:40 p.m.
[2]Estimated discharge.
[3]Flooding.

Table 3.--Field measurements at tributary sites draining into Cypress Creek in April, June, July, and August 1979

[Measurements by U.S. Geological Survey; °C, degree Celsius; µmho/cm, micromho per centimeter; ft^3/s, foot per second]

Site	1G	3	10	5	6	9
Sampling date (1979)	April 11	April 10	April 10	April 10	April 10	April 10
Time (eastern standard)	1105	[1]1800	1600	1455	1607	1540
Water temperature (°C)	14.7	10.8	10.5	12.5	12.7	12.4
Air temperature (°C)	---------	9.9	10.5	11.0	10.0	11.0
pH	1.2	7.7	7.3	7.2	7.2	8.0
Eh, oxidation-reduction potential (millivolts)	+670	+275	+260	+300	+240	+400
Specific conductance (µmho/cm at 25°C)	1,700	1,300	1,250	2,000	2,090	3,200
Dissolved oxygen (mg/L)	10.4	11.6	11.6	13.6	13.0	14.0
Dissolved oxygen (percent saturation)	98	105	105	128	124	132
Weather	Overcast, intermittent rain, and warm					

Site	13A	13B	12	26	18	21
Sampling date (1979)	April 10	April 10	April 10	April 10	April 10	April 10
Time (eastern standard)	1510	1520	1620	1640	1705	1715
Water temperature (°C)	11.5	12.1	10.7	11.4	11.1	10.6
Air temperature (°C)	10.5	9.5	11.5	10.0	9.2	9.3
pH	7.5	7.6	7.9	8.0	7.7	7.8
Eh, oxidation-reduction potential (millivolts)	+410	+420	+350	+345	+380	+182
Specific conductance (µmho/cm at 25°C)	3,500	2,810	2,000	1,800	1,300	690
Dissolved oxygen (mg/L)	14.6	15.2	14.2	14.0	13.2	12.3
Dissolved oxygen (percent saturation)	138	142	131	130	119	113
Weather	Overcast, intermittent rain, and warm					

Table 3.--Field measurements at tributary sites draining into Cypress Creek in April, June, July, and August 1979--Continued

Site	3	5	5A	5B	5C	6	9
Sampling date (1979)	June 12	June 13	June 13	June 13	June 13	June 13	June 13
Time (eastern standard)	--------	0955	1330	1335	1350	1410	1050
Water temperature (°C)	29.2	21.2	19.0	26.0	21.3	25.6	22.7
Air temperature (°C)	--------	29.0	32.5	32.0	29.0	30.5	29.5
pH	7.7	8.0	6.7	7.7	7.7	8.4	7.9
Eh, oxidation-reduction potential (millivolts)	--------	+222	+224	+275	+252	+225	+217
Specific conductance (umho/cm at 25°C)	1,650	2,520	2,360	1,880	2,270	2,440	3,850
Dissolved oxygen (mg/L)	11.6	9.7	6.7	6.7	5.5	14.0	6.4
Dissolved oxygen (percent saturation)	147	123	67	80	60	165	73
Instantaneous stream discharge (ft^3/s)	--------	1.09	--------	--------	--------	--------	1.20
Weather	Hot, humid, and sunny						

Site	10	12	13A	13B	14	18	21	26
Sampling date (1979)	June 12	June 12	June 12	June 12	June 13	June 13	June 12	June 13
Time (eastern standard)	--------	1430	1325		1515	1445	1130	1440
Water temperature (°C)	26.5	29.2	26.9	N	28.5	27.8	25.5	27.6
Air temperature (°C)	--------	30.5	--------	o	29.0	29.5	29.0	29.5
pH	8.0	8.2	8.1		8.0	8.1	7.9	8.1
Eh, oxidation-reduction potential (millivolts)	--------	+290	+266	F l	+260	+242	+302	+240
Specific conductance (umho/cm at 25°C)	2,295	3,540	4,370	o	2,710	2,430	500	2,000
Dissolved oxygen (mg/L)	15.6	12.8	10.1	w	14.7	17.1	6.8	9.1
Dissolved oxygen (percent saturation)	188	163	124		184	212	80	112
Instantaneous stream discharge (ft^3/s)	--------	1.47	--------		--------	--------	.17	--------
Weather	Hot, humid, and sunny							

Table 3.--Field measurements at tributary sites draining into Cypress Creek in April, June, July, and August 1979--Continued

Site	3	5	6	9	10
			July 25, 1979		
Time (eastern standard)	1300	1450	1307	1313	1255
Water temperature (°C)	25.5	23.8	22.5	24.0	23.4
pH	7.4	7.4	7.4	7.9	7.5
Eh, oxidation-reduction potential (millivolts)	+365	+268	+380	+790	+370
Specific conductance (Umho/cm at 25°C)	1,300	1,900	1,600	2,850	1,555
Dissolved oxygen (mg/L)	7.3	7.8	7.2	7.0	7.2
Dissolved oxygen (percent saturation)	86	90	81	80	83
Weather	Overcast, hot, humid, and occasional light rain				

Site	12	14	18	21	26
			July 25, 1979		
Time (eastern standard)	1330	1338	1435	1420	1425
Water temperature (°C)	24.5	24.0	22.0	25.8	25.5
pH	7.6	7.3	7.4	8.2	7.8
Eh, oxidation-reduction potential (millivolts)	+320	+330	+270	+310	+340
Specific conductance (Umho/cm at 25°C)	1,600	1,100	1,100	900	1,900
Dissolved oxygen (mg/L)	7.4	6.7	7.7	9.4	9.6
Dissolved oxygen (percent saturation)	86	77	86	112	114
Weather	Overcast, hot, humid, and occasional light rain				

Table 3.--Field measurements at tributary sites draining into Cypress Creek in April, June, July, and August 1979--Continued

Site	3	5	6	9	10
August 13, 1979					
Time (eastern standard)	1735	1525	1540	1558	1740
Water temperature (°C)	28.5	25.5	25.5	24.4	25.5
pH	8.0	7.9	8.2	8.1	8.2
Eh, oxidation-reduction potential (millivolts)	+350	+380	+380	+260	+300
Specific conductance (μmho/cm at 25°C)	1,950	2,000	2,420	3,900	2,300
Dissolved oxygen (mg/L)	8.0	8.0	12.2	8.5	15.8
Dissolved oxygen (percent saturation)	120	94	144	99	97
Weather	Warm and partly cloudy				

Site	12	14	18	21	26
August 13, 1979					
Time (eastern standard)	1605	1610	1650	1635	1645
Water temperature (°C)	29.0	25.8	28.5	28.8	28.9
pH	8.0	7.5	8.0	8.1	8.4
Eh, oxidation-reduction potential (millivolts)	+260	+120	+355	+340	+350
Specific conductance (μmho/cm at 25°C)	3,180	3,400	3,200	742	2,200
Dissolved oxygen (mg/L)	14.4	11.0	11.8	7.6	12.5
Dissolved oxygen (percent saturation)	182	131	149	96	158
Weather	Warm and partly cloudy				

[1] For example, 1800 is 6:00 p.m.

Table 4.--Chemical analyses of water samples from the Cypress Creek watershed

[Analyses by U.S. Geological Survey; °C, degree Celsius]

Date of sampling (1979)	April 11		April 12		June 12			
Site	1	2	11	19	1	2	11	19
Eastern standard time	1105	[1]1440	1000	1805	1830	1630	1410	1045
Milligrams per liter								
Alkalinity, total (as $CaCO_3$)	39	51	62	78	120	120	190	180
Aluminum (Al)	0.20	.20	.20	.20	.40	.20	.20	.20
Aluminum (Al), suspended	-------	-------	-------	-------	.45	.06	.58	.34
Aluminum (Al), total	-------	-------	-------	-------	.85	.26	.78	.54
Calcium (Ca)	110	100	84	95	190	180	210	210
Chloride (Cl)	5.0	5.7	6.1	6.3	6.4	11.0	9.5	9.9
Fluoride (F)	0.2	.2	.2	.2	.3	.4	.3	.4
Hardness, noncarbonate	460	410	320	370	850	780	870	880
Hardness, total (as $CaCO_3$)	500	460	390	440	970	900	1,100	1,100
Iron (Fe)	3.4	.67	.01	.03	.21	.01	.01	.11
Iron (Fe), suspended	-------	-------	-------	-------	3.8	.99	1.7	.99
Iron (Fe), total	-------	-------	-------	-------	4.0	1.0	1.7	1.1
Magnesium (Mg)	55	52	43	50	120	110	130	130
Manganese (Mn)	1.1	1.1	.68	.07	.73	.68	.72	.61
Manganese (Mn), suspended	-------	-------	-------	-------	.04	.0	.03	.03
Manganese (Mn), total	-------	-------	-------	-------	.77	.67	.75	.64
Potassium (K)	3.4	3.3	3.2	3.3	4.2	4.3	4.3	4.2
Dissolved solids (residue on evaporation at 180°C)	802	759	626	709	1,540	1,470	1,360	1,790
Silica (SiO_2)	6.7	7.1	5.6	21.0	5.9	6.7	6.4	6.3
Sodium (Na)	25	25	26	35	62	59	77	88
Sulfate (SO_4)	530	500	370	410	960	910	860	1,000
Sodium-adsorption ratio (SAR)	0.5	.5	.6	.7	.9	.9	1.0	1.2
Percent sodium	10	10	13	15	12	12	14	15

Table 4.--Chemical analyses of water samples from the Cypress Creek watershed--Continued

Date of sampling (1979)	June 13		June 12		August 14			
Site	5	9	12	21	1	2	11	19
Eastern standard time	0955	1050	1430	1130	1600	1410	1205	0750
Milligrams per liter								
Alkalinity, total (as $CaCO_3$)	180	340	280	70	110	130	160	170
Aluminum (Al)	0.20	.20	.30	.20	.08	.04	.20	.03
Aluminum (Al), suspended	0.0	.70	0	1.8	.69	.08	.09	.16
Aluminum (Al), total	0.18	.90	.15	2.0	.77	.12	.29	.19
Calcium (Ca)	370	470	350	47	170	160	290	220
Chloride (Cl)	5.7	6.1	9.9	20.0	5	16	11	11
Fluoride (Fl)	0.5	.3	.2	.3	.3	.4	.4	.4
Hardness, noncarbonate	1,800	2,700	3,000	110	730	620	1,100	960
Hardness, total (as $CaCO_3$)	2,000	3,100	3,300	180	840	750	1,300	1,100
Iron (Fe)	0.03	.04	.04	0	.02	.03	.08	.05
Iron (Fe), suspended	0.51	2.6	.3	4.1	7.3	.68	.82	.50
Iron (Fe), total	0.54	2.60	.34	4.1	7.3	.71	.90	.55
Magnesium (Mg)	260	460	580	16	100	86	140	140
Manganese (Mn)	1.9	3.0	.1	.04	.41	.41	.40	.32
Manganese (Mn), suspended	0.20	1.1	.03	.29	.05	0	.02	.02
Manganese (Mn), total	2.1	4.1	.13	.33	.46	.41	.42	.34
Potassium (K)	3.7	5.1	5.0	1.7	4.4	4.9	5.1	4.8
Dissolved solids (residue on evaporation at 180°C)	2,520	4,040	3,470	316	1,410	1,300	1,780	1,750
Silica (SiO_2)	10.0	10.0	7.0	5.3	5.7	8.7	7.0	7.8
Sodium (Na)	36	130	180	33	50	53	80	100
Sulfate (SO_4)	1,500	2,600	2,100	150	850	740	1,000	1,000
Sodium-adsorption ratio (SAR)	0.4	1.0	1.4	1.1	.8	.8	1.0	1.3
Percent sodium	4	8	11	28	11	13	12	16

[1]For example, 1440 is 2:40 p.m.

Table 5.--Concentrations of nitrogen and phosphorus in water and streambed samples from the Cypress Creek watershed

[Analyses by U.S. Geological Survey; mg/L, milligram per liter; mg/kg, milligram per kilogram]

Date of sampling (1979)	April 11		April 12		June 12			
Site	1	2	11	19	1	2	11	19
Eastern standard time	1105	[1]1440	1000	1805	1830	1630	1410	1045
Water samples								
Nitrogen, ammonia, dissolved as NH_4 (mg/L)	0.26	.32	.24	.21	.40	.35	.52	.48
Nitrogen, dissolved organic as N (mg/L)	0.14	.28	.77	.74	.26	.27	.30	.31
Nitrogen, dissolved as N (mg/L)	0.93	1.2	1.9	1.9	1.7	2.3	2.2	2.0
Nitrogen, dissolved Kjeldahl as N (mg/L)	0.34	.53	.96	.90	.57	.27	.40	.37
Nitrogen, ammonia, dissolved as N (mg/L)	0.20	.25	.19	.16	.31	.27	.40	.37
Nitrite plus nitrate, dissolved as N (mg/L)	0.59	.71	.93	.97	1.1	1.8	1.5	1.3
Phosphorus, dissolved orthophosphate as P (mg/L)	0.00	.00	.00	.00	.00	.06	.00	.00
Phosphate, ortho, dissolved (PO_4) as P (mg/L)	0.00	.00	.00	.00	.00	.18	.00	.00
Phosphorus, dissolved as P (mg/L)	0.00	.00	.01	.02	.00	.10	.02	.01

Date of sampling (1979)	April 11		April 12		June 12			
Site	1	2	11	19	1	2	11	19
Eastern standard time	1105	[1]1440	1000	1805	1830	1630	1410	1045
Streambed samples								
Nitrogen, total as nitrogen (mg/kg)	17,000	18,000	8,600	5,700	16,000	20,000	9,000	6,200
Phosphorus, total as phosphorus (mg/kg)	0	0	1	0	380	1,900	1,700	940

Table 5.--Concentrations of nitrogen and phosphorus in water and streambed samples from the Cypress Creek watershed--Continued

Date of sampling (1979)	June 13		June 12		August 14			
Site	5	9	12	21	1	2	11	19
Eastern standard time	0955	1050	1430	1130	1600	1410	1205	0905
Water samples								
Nitrogen, ammonia, dissolved as NH_4 (mg/L)	0.15	.27	.10	.03	.08	----	1.2	.17
Nitrogen, dissolved organic as N (mg/L)	0.24	.26	.62	.22	.48	----	.67	.15
Nitrogen, dissolved as N (mg/L)	0.49	.66	.85	.89	1.4	3.6	2.4	1.4
Nitrogen, dissolved Kjeldahl as N (mg/L)	0.36	.47	.70	.24	.54	3.0	1.6	.28
Nitrogen, ammonia, dissolved as N (mg/L)	0.12	.21	.08	.02	.06	----	.93	.13
Nitrite plus nitrate, dissolved as N (mg/L)	0.13	.19	.15	.65	.85	.62	.83	1.1
Phosphorus, dissolved orthophosphate as P (mg/L)	0.00	.08	.00	.00	.00	.14	.02	.00
Phosphate, ortho, dissolved (PO_4) as P (mg/L)	0.00	.25	.00	.00	.00	.42	.06	.00
Phosphorus, dissolved as P (mg/L)	0.01	.11	.05	.01	.00	.20	.02	.02

Date of sampling (1979)	June 13		June 12		August 14			
Site	5	9	12	21	1	2	11	19
Eastern standard time	0955	1050	1430	1130	1600	1410	1205	0905
Streambed samples								
Nitrogen, total as nitrogen (mg/kg)	5,200	7,000	5,200	3,200	23,000	20,000	5,000	4,600
Phosphorus, total as phosphorus (mg/kg)	4,500	740	360	760	370	1,400	720	880

[1]For example, 1440 is 2:40 p.m.

Table 6.--Concentrations of aluminum, iron, and manganese in streambed samples from the Cypress Creek watershed

[Analyses by U.S. Geological Survey; ug/kg, microgram per kilogram]

Date of sampling (1979)	April 11		April 12	
Site	1	2	11	19
Eastern standard time	1105	[1]1440	1000	1805
Aluminum (ug/kg)	7,500	6,000	11,000	9,000
Iron (ug/kg)	34,000	29,000	35,000	26,000
Manganese (ug/kg)	360	1,100	680	460
Date of sampling (1979)	June 12			
Site	1	2	11	19
Eastern standard time	1830	1630	1410	1045
Aluminum (ug/kg)	3,600	7,100	8,400	8,500
Iron (ug/kg)	32,000	46,000	39,000	28,000
Manganese (ug/kg)	260	370	420	290
Date of sampling (1979)	June 13		June 12	
Site	5	9	12	21
Eastern standard time	0955	1050	1430	1130
Aluminum (ug/kg)	11,000	5,900	4,600	5,100
Iron (ug/kg)	48,000	20,000	15,000	39,000
Manganese (ug/kg)	2,100	1,500	450	3,100
Date of sampling (1979)	August 14			
Site	1	2	11	19
Eastern standard time	1600	1410	1205	0950
Aluminum (ug/kg)	4,800	7,200	11,000	9,400
Iron (ug/kg)	26,000	51,000	34,000	34,000
Manganese (ug/kg)	320	540	400	600

[1]For example, 1440 is 2:40 p. m.

Table 7.--Concentrations of organic carbon in streambed and water samples from the Cypress Creek watershed

[Analyses by U.S. Geological Survey; mg/L, milligram per liter; g/kg, gram per kilogram]

Date of sampling (1979)	April 11		April 12		June 12			
Site	1	2	11	19	1	2	11	19
Eastern standard time	1105	[1]1440	1000	1805	1830	1630	1410	1045
Water samples								
Carbon, dissolved organic (mg/L)	5.0	7.8	3.3	---	9.3	7.1	5.8	11.0
Carbon, suspended organic (mg/L)	0.6	.6	2.4	---	0.4	.6	---	.9
Carbon, total organic (mg/L)	5.6	8.4	5.7	---	9.7	7.7	---	11.9
Streambed samples								
Carbon (g/kg)	---	---	---	---	0.3	.1	2.6	.4
Carbon, organic (g/kg)	---	---	---	---	280	105	38	29
Carbon, total (g/kg)	---	---	---	---	280.3	105.1	40.6	29.4

Date of sampling (1979)	June 13		June 12		August 14			
Site	5	9	12	21	1	2	11	19
Eastern standard time	0955	1050	1430	1130	1600	1410	1205	0950
Water samples								
Carbon, dissolved organic (mg/L)	3.2	3.9	5.9	5.1	5.9	6.3	5.9	4.1
Carbon, suspended organic (mg/L)	0.4	3.7	.5	1.8	0.3	.2	---	.2
Carbon, total organic (mg/L)	3.6	7.6	6.4	6.9	6.2	6.5	---	4.3
Streambed samples								
Carbon (g/kg)	1.1	5.5	4.5	1.7	0.3	1.0	.8	2.1
Carbon, organic (g/kg)	24	27	16	13	142	96	21	18
Carbon, total (g/kg)	25.1	32.5	20.5	14.7	142.3	97	21.8	20.1

[1]For example, 1440 is 2:40 p.m.

Table 8.--Concentrations of chlorinated hydrocarbons in surface and core streambed samples from the Cypress Creek watershed

[Analyses by U.S. Geological Survey; PCB, polychlorinated biphenyl, PCN, polychlorinated naphthalene; ND, not detected; all units Ug/kg, microgram per kilogram]

Date of sampling (1979)	April 11		April 12		June 12		June 13		June 12		July 25				
	Streambed samples														Core[2] sample
Site[1]	1	2	11	19	1	19	5	9	12	21	1	2	11	19	11
Aldrin	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Chlordane	4	[3]30	ND	[3]130	ND	[3]91	[3]68	12	[3]110	7.0	ND	[3]96	[3]29	[3]54	6
DDD	ND	.6	ND	ND	ND	ND	2.2	ND	5.5	ND	4.5	ND	ND	ND	3.1
DDE	ND	.4	1.6	ND	ND	ND	ND	ND	ND	1.0	1.6	11	5.1	2.6	.5
DDT	2.7	1.3	5.4	ND	1.4	ND	ND	ND	ND	3.9	[3]28	14	4.5	.8	ND
Dieldrin	ND	ND	17	5.1	1.2	3.6	6.0	ND	9.3	4.2	1.5	12	5.3	17	ND
Endosulfan	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Endrin	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Heptachlor epoxide	ND	ND	1.9	ND	1.1	ND	ND	ND	ND	ND	.5	5	1.5	2.2	ND
Heptachlor	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Lindane	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Mirex	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
PCB	[3]32	[3]92	[3]62	[3]34	[3]100	[3]34	12	10	ND	ND	[3]62	[3]330	[3]39	[3]45	[3]42
PCN	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Perthane	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Toxaphene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND

[1]Site numbers are plotted in figure 2.
[2]Core sample, 2-ft depth, taken in stream bottom on upstream side of bridge at site 11, left edge of water.
[3]Exceeds water-quality alert limit of 20 Ug/kg for chlordane, DDT, and PCB's set by the U.S. Environmental Protection Agency (1976, p. 240, 254, and 364).

Table 9.--Concentrations of suspended sediment in the Cypress Creek watershed

[Data obtained by U.S. Geological Survey; mg/L, milligram per liter]

Site	Sampling date (1979)	Eastern standard time	Concentration (mg/L)	Total concentration, Cypress Creek (mg/L)
1	4-11	1105	33	
2	4-11	[1]1440	42	
11	4-12	1000	362	
19	4-12	1805	339	776
1	6-12	1830	21	
2	6-12	1630	13	
11	6-12	1513	38	
19	6-12	1045	61	133
5	6-13	0955	15	
9	6-13	1050	21	
12	6-12	1530	28	
21	6-12	1130	78	---
1	8-14	1600	---	
2	8-14	1410	---	
11	8-14	1205	---	
19	8-14	0950	---	91

[1]For example, 1440 is 2:40 p.m.

Table 10.--Sieve analysis of a composite of the suspended-sediment samples from Cypress Creek, August 14, 1979

[Analysis by U.S. Geological Survey]

Sediment fraction size	Weight in grams	Percent finer than	Percent
Silt and clay	0.1408	--	96.0
0.062 mm sand	.0017	99	1.2
0.125 mm sand	.0034	96	2.3

Total weight of sediment: 0.1459 gram.
Weight of water sediment mixture: 1,598.0 grams.
Mean concentration of suspended sediment in Cypress Creek: 91.0 milligrams per liter.

Table 11.--Bacterial data for streams in the Cypress Creek watershed

[Counts and ratios determined by U.S. Geological Survey; mL, milliliter]

Site	Sampling date (1979)	Colonies per 100 mL		Fecal coliform / Fecal streptococcus
		Fecal coliform	Fecal streptococcus	
1	4-10	300	253	1.19
2	4-10	1,435	980	1.46
11	4-10	6,127	1,750	3.50
19	4-10	797	207	3.85
1	6-11	228	133	1.71
2	6-11	5,500	510	10.78
11	6-11	5,800	257	22.57
19	6-11	2,782	153	18.18
5	6-11	900	1,825	.49
9	6-11	6,233	3,310	1.88
12	6-11	105	113	.93
21	6-11	940	1,440	.65
2	8-13	27,200	190	143.20
11	8-13	30	1,580	.02
19	8-13	20	1,123	.02

Table 12.--Periphyton data for Cypress Creek, colonization period, June 13 through August 13, 1979

[Analyses by U.S. Geological Survey;
X, sample contains organism;
D, dominant organism; g/m^2, gram per square meter;
ND, not detected]

Organism	Site 1	Site 2
Chrysophyta (yellow-brown algae and diatoms and pennates)		
Bacillariophyceae	X	X
Naviculaceae	ND	X
Navicula	ND	D
Nitzschiaceae	X	X
Nitzschia	D	D
Pennales	X	X
Biomass, ASH (g/m^2)	8.89	9.01
Biomass, DRY (g/m^2)	13.10	11.20
Biomass, ACTUAL (g/m^2)	4.21	2.19

☆ U.S. GOVERNMENT PRINTING OFFICE: 1980—653-844/214

[illegible]

THIRD MEETING

12-11-02

CITY OF BOONVILLE L.T.C.P.
CITIZENS ADVISORY COMMITTEE
AGENDA
DECEMBER 11, 2002

1. Approve minutes of November 26, 2002 meeting.

2. Review letter from United States Department of the Interior, Fish and Wildlife Services.

3. Consider recommendation to Board of Works concerning sensitive areas.

4. Review and Comment on alternatives to be evaluated.

5. Next Meeting.

BOONVILLE L.T.C.P.
CITIZEN ADVISORY COMMITTEES
MINUTES OF DECEMBER 11, 2002

Mayor Hendrickson called meeting to order. Members present being Mayor Hendrickson, Ron Tubbs, Steve Byers and David Dahl. Mr. Stone was out of State. Rob Burton had a family emergency and could not attend, Mike filled in.

The revised minutes of the November 14, 2002 meeting were reviewed, as were the minutes of the November 26, 2002 meeting. Both sets of minutes were approved.

Mr. Dahl then presented a letter from U.S. Fish & Wildlife which identified that the Indiana Bat & Bald Eagle have foraging habitat in the vicinity and that clearly operations should be coordinated with Fish & Wildlife.

Tabulation of CSO flow reports for 12 months ending September 02 were reviewed. For the period 218 MG were discharged from the South CSO. This data was then adjusted to reflect the impact of the new plant. It was estimated that overflow volume would be reduced to 124 MG at the North CSO and 157 MG at the South CSO. The new plant will greatly reduce CSO volume.

A discussion of sensitive areas followed a formal recommendation was discussed for consideration these ranged from complete sewer separation to simple screening. A total of six were identified for further consideration, a copy of this list is attached.

The next meeting will be on December 23, 2002 at 9:30 a.m. local time.

Quality Engineer Services Since 1959
Consultants • Mechanical • Electrical • Civil

Midwestern Engineers Inc.

DAVID L. DAHL, P.E.
MICHAEL J. MATHIAS, P.E.
RICHARD A. BURCH, P.E.
GREGORY A. MANGIN, P.E.
JOHN W. WETZEL, P.E.
EMERITUS
ROBERT J. ELLIOTT, P.E.
ARTHUR R. BODDY, P.E.
JAMES E. BURCH, P.E.
WM. DALE MEYER, P.E.

June 11, 2001

U.S. Fish and Wildlife
Division of Ecological Services
620 S. Walker Street
Bloomington, IN. 47403

Attn: Mr. David C. Hudak, Supervisor

Re: City of Boonville
Combined Sewer Operational and Long Term Control Plan
MEI Project # 200025-06

Dear Mr. Hudak,

Enclosed please find a quadrangle map that shows the combined sewer overflow points for the City of Boonville as well as a sewer overall map. The combined sewer overflow structures are existing and discharge combined sewer to Cypress Creek during wet weather periods.

In order to obtain environmental information relating to these existing combined sewer overflows, we ask for your assistance in identifying the following land uses or environmental resources:

1. Wilderness Refuge
2. Wetlands
3. Wilderness (designated or proposed under the Wilderness Act)
4. Wild or Scenic Rivers (designated or proposed under the Wild and Scenic Rivers Act)
5. Critical Habitat (endangered or threatened species)
6. Wildlife

Should you need further information to proceed with your review of the project, please advise immediately. Thank you for your time and cooperation on this matter.

Sincerely,

MIDWESTERN ENGINEERS, INC.

Brian A. Bullock, E.I.
Assistant Project Engineer

BAB/bab

Enclosures

David's Copy RECD NOV 27 2002

United States Department of the Interior

FISH AND WILDLIFE SERVICE

BLOOMINGTON FIELD OFFICE (ES)
620 South Walker Street
Bloomington, IN 47403-2121
(812) 334-4261 FAX (812) 334-4273

November 25, 2002

Mr. Brian Bullock
Midwestern Engineers, Inc.
P.O. Box 295
Loogootee, Indiana 47553-0295

Dear Mr. Bullock:

This responds to your letter of, 2002 requesting endangered species information from the U.S. Fish and Wildlife Service (FWS) for a combined sewer overflow (CSO) study for the town of Boonville in Warrick County, Indiana.

These comments have been prepared under the authority of the Fish and Wildlife Coordination Act (16 U.S.C. 661 et. seq.) and are consistent with the intent of the National Environmental Policy Act of 1969, the Endangered Species Act of 1973, and the U. S. Fish and Wildlife Service's Mitigation Policy.

The study area focuses on Cypress Creek. Attached is an excerpt from a National Wetland Inventory map depicting wetlands within the study area.

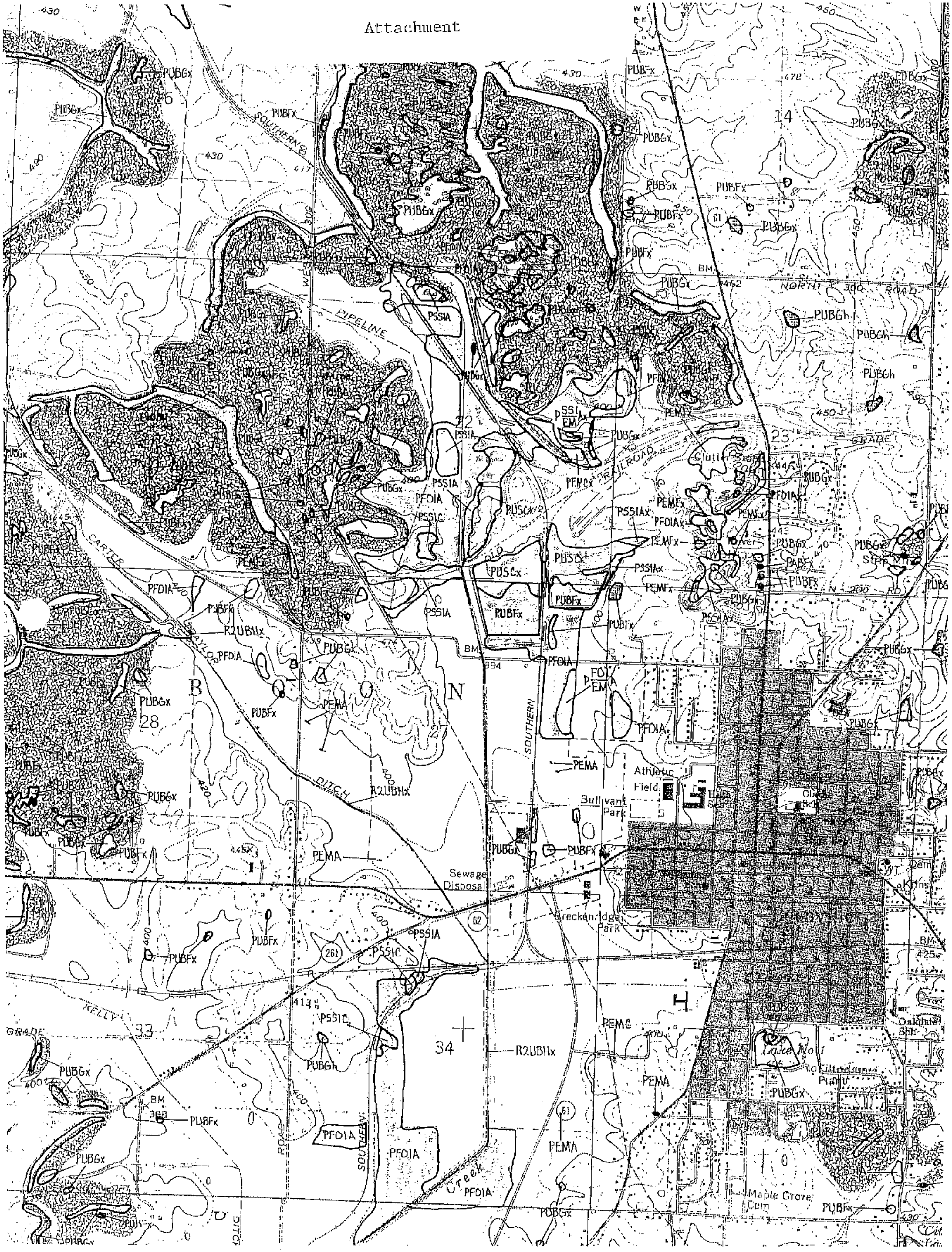
Endangered Species

Warrick County is within the range of the federally endangered Indiana bat (*Myotis sodalis*) and federally threatened bald eagle (*Haliaeetus leucocephalus*).

Indiana bats hibernate in caves, then disperse to reproduce and forage in relatively undisturbed forested areas associated with water resources during spring and summer. Young are raised in nursery colony roosts in trees, typically near forested drainageways in undeveloped areas.

There are no caves in Warrick County, and no recent summer records of Indiana bats, however to our knowledge the county has not been thoroughly surveyed. There is suitable summer habitat for this species present in forested areas of the Cypress Creek corridor and its tributaries. If minor tree-clearing is proposed within suitable habitat, to avoid incidental take from removal of an occupied roost tree we recommend that tree-clearing be avoided during the period April 15 - September 15. If substantial tree-

Attachment


PUBGx
PUBFx
PUBGh
PUBFx
PSS1A
PSS1C
PFO1A
PFO1Ax
PEMA
PEMC
PEMCx
PEMFx
PUSCx
PABFx
R2UBHx
SOUTHERN
PIPELINE
RAILROAD
CARTER
DITCH
KELLY
GRADE
NORTH 300 ROAD
N 200 RD
Athletic Field
Bullivant Park
Sewage Disposal
Breckenridge Park
Lake No 1
Maple Grove Cem
Creek
ROAD
B
O
N
H
14
16
22
23
27
28
33
34
430
450
400
420
BM
394
388
425
62
261
61

CSO FLOW DATA
OCTOBER, 2001 THRU SEPTEMBER, 2002

Date	Precipitation Inches	Influent Flow MGD	North CSO Overflow Volume MGD	South CSO Overflow Volume MGD
1-Oct-01		0.860		
2-Oct-01		0.830		
3-Oct-01		0.839		
4-Oct-01		0.863		
5-Oct-01	1.05	1.700		
6-Oct-01		1.566		
7-Oct-01		1.530		
8-Oct-01		1.413		
9-Oct-01		0.855		
10-Oct-01	0.07	1.450		
11-Oct-01	1.40	2.300	2.000	2.500
12-Oct-01	0.01	2.300		
13-Oct-01	1.13	2.250		
14-Oct-01	0.76	2.250	2.250	2.750
15-Oct-01	0.10	2.150		
16-Oct-01		2.050		
17-Oct-01		2.000		
18-Oct-01		1.650		
19-Oct-01		1.450		
20-Oct-01		1.150		
21-Oct-01		1.205		
22-Oct-01		1.496		
23-Oct-01	2.60	1.925	4.074	3.172
24-Oct-01	1.32	2.150	10.920	10.448
25-Oct-01		2.525	0.720	2.068
26-Oct-01		2.525		0.552
27-Oct-01		2.700		
28-Oct-01		2.450		
29-Oct-01		1.625		
30-Oct-01		1.400		
31-Oct-01		1.250		
Totals	8.440	52.707	19.964	21.490
Average		1.700	3.993	3.582
No. of Overflow days			5	6

Date	Precipitation Inches	Influent Flow MGD	North CSO Overflow Volume MGD	South CSO Overflow Volume MGD
1-Nov-01		1.100		
2-Nov-01	0.04	1.250		
3-Nov-01		1.366		
4-Nov-01		1.328		
5-Nov-01		1.299		
6-Nov-01		1.192		
7-Nov-01		1.214		
8-Nov-01		1.198		
9-Nov-01		1.254		
10-Nov-01		1.100		
11-Nov-01		1.124		
12-Nov-01		1.097		
13-Nov-01		1.244		
14-Nov-01		1.116		
15-Nov-01		1.126		
16-Nov-01		1.100		
17-Nov-01		1.113		
18-Nov-01		1.096		
19-Nov-01	0.29	1.650		
20-Nov-01		1.325		
21-Nov-01		1.103		
22-Nov-01		1.024		
23-Nov-01	0.01	1.043		
24-Nov-01	1.03	1.900	1.778	3.669
25-Nov-01		2.500		
26-Nov-01	0.37	2.700		
27-Nov-01	0.38	2.712	19.224	29.498
28-Nov-01	1.74	2.638		
29-Nov-01	1.3	2.400		
30-Nov-01	0.02	2.550		
Totals	5.18	44.862	21.002	33.167
Average		1.495	10.501	16.584
No. of Overflow Days			2	2

Date	Precipitation Inches	Influent Flow MGD	North CSO Overflow Volume MGD	South CSO Overflow Volume MGD
1-Dec-01		2.100		
2-Dec-01		2.000		
3-Dec-01		2.300		
4-Dec-01		2.350		
5-Dec-01		1.729		
6-Dec-01	0.7	0.556	5.316	4.682
7-Dec-01		2.400		
8-Dec-01	0.23	2.850		
9-Dec-01		2.400		
10-Dec-01		2.500		
11-Dec-01		2.300		
12-Dec-01	0.86	2.150	7.982	32.475
13-Dec-01	0.15	2.600		
14-Dec-01	0.37	2.653		
15-Dec-01		2.250		
16-Dec-01	2.37	2.400	12.122	
17-Dec-01	1.95	2.300		
18-Dec-01		2.500		
19-Dec-01	0.01	2.229		
20-Dec-01		2.159		
21-Dec-01		2.400		
22-Dec-01	0.46	2.400	0.950	3.711
23-Dec-01	0.08	2.325		
24-Dec-01		2.646		
25-Dec-01		2.402		
26-Dec-01		2.820		
27-Dec-01		2.400		
28-Dec-01		2.200		
29-Dec-01	0.01	1.822		
30-Dec-01		1.722		
31-Dec-01		1.710		
Totals	7.19	69.573	26.370	40.868
Average		2.244	6.593	13.623
No. of Overflow Days			4	3

Date	Precipitation Inches	Influent Flow MGD	North CSO Overflow Volume MGD	South CSO Overflow Volume MGD
1-Jan-02		1.597		1.500
2-Jan-02		1.594		1.010
3-Jan-02		1.570		0.500
4-Jan-02		1.447		
5-Jan-02		1.685		
6-Jan-02	0.26	1.176		
7-Jan-02		1.176		
8-Jan-02		1.610		
9-Jan-02		1.621		
10-Jan-02	0.01	1.573		
11-Jan-02		1.958		
12-Jan-02		1.697		
13-Jan-02		1.541		
14-Jan-02		1.445		
15-Jan-02		1.652		
16-Jan-02		1.395		
17-Jan-02		1.329		
18-Jan-02		1.677		
19-Jan-02	0.24	1.750		
20-Jan-02		1.535		
21-Jan-02		1.642		
22-Jan-02		1.615		
23-Jan-02	0.71	2.100	3.500	7.830
24-Jan-02	0.71	1.838	3.000	1.193
25-Jan-02		2.397	2.000	0.486
26-Jan-02		2.141	1.000	0.160
27-Jan-02		2.214		
28-Jan-02		2.310		
29-Jan-02		2.449		
30-Jan-02		1.865	4.500	4.750
31-Jan-02		2.315	3.500	3.250
Totals	1.93	53.914	17.500	20.679
Average		1.739	2.917	2.298
No. of Overflow Days			6	9

Date	Precipitation Inches	Influent Flow MGD	North CSO Overflow Volume MGD	South CSO Overflow Volume MGD
1-Feb-02		2.900	1.500	1.500
2-Feb-02		2.514		1.010
3-Feb-02		2.459		0.500
4-Feb-02		2.594		
5-Feb-02		2.500		
6-Feb-02	0.03	2.678		
7-Feb-02		2.573		
8-Feb-02		2.310		
9-Feb-02		2.350		
10-Feb-02	0.01	2.450		
11-Feb-02		2.050		
12-Feb-02		2.050		
13-Feb-02		1.972		
14-Feb-02		1.480		
15-Feb-02		2.788		
16-Feb-02		1.559		
17-Feb-02		1.417		
18-Feb-02		1.634		
19-Feb-02	0.31	2.000		
20-Feb-02	0.14	2.250		
21-Feb-02		1.900		
22-Feb-02		1.593		
23-Feb-02		1.450		
24-Feb-02		1.400		
25-Feb-02	0.44	1.595		
26-Feb-02	0.01	2.450		
27-Feb-02		2.687		
28-Feb-02		1.800		
Totals	0.94	59.403	1.5	3.01
Average		2.122	1.500	1.003
No. of Overflow Days			1	3

Date	Precipitation Inches	Influent Flow MGD	North CSO Overflow Volume MGD	South CSO Overflow Volume MGD
1-Mar-02		1.460		
2-Mar-02	0.92	2.250	2.297	3.702
3-Mar-02		2.250	0.252	1.795
4-Mar-02		2.425		0.472
5-Mar-02		2.450		
6-Mar-02		2.200		
7-Mar-02		2.000		
8-Mar-02		1.600		
9-Mar-02	0.86	2.240	0.829	3.375
10-Mar-02		2.200	0.006	1.605
11-Mar-02	0.11	2.200	0.005	0.952
12-Mar-02	0.01	2.500		0.580
13-Mar-02		2.415		0.002
14-Mar-02		2.250		
15-Mar-02	0.75	2.150	0.326	1.085
16-Mar-02		2.500	2.421	3.958
17-Mar-02	0.03	2.452	0.164	1.680
18-Mar-02	0.08	2.625	0.035	0.851
19-Mar-02	1.69	2.593	4.403	5.467
20-Mar-02	0.51	2.750	9.102	10.377
21-Mar-02		2.800	1.053	2.482
22-Mar-02		2.650	0.014	1.378
23-Mar-02		2.143		0.315
24-Mar-02	0.01	2.260		
25-Mar-02	1.31	2.900	3.046	5.164
26-Mar-02	0.31	2.725	9.791	8.664
27-Mar-02		2.500	1.004	2.437
28-Mar-02	0.01	3.000	0.011	0.857
29-Mar-02	0.36	2.800	0.089	2.175
30-Mar-02		2.600		1.072
31-Mar-02		2.725		0.178
Totals	6.96	74.613	34.848	60.623
Average		2.407	1.936	2.526
No. of Overflow Days			18	24

Date	Precipitation Inches	Influent Flow MGD	North CSO Overflow Volume MGD	South CSO Overflow Volume MGD
1-Apr-02		2.525		
2-Apr-02	0.16	2.500		
3-Apr-02		2.300		
4-Apr-02		2.300		
5-Apr-02		2.100		
6-Apr-02		2.300		
7-Apr-02		2.000		
8-Apr-02	0.36	2.000		
9-Apr-02	0.01	2.100		
10-Apr-02		2.300		
11-Apr-02		2.000		
12-Apr-02	0.50	2.754	1.014	6.412
13-Apr-02	1.32	2.100	10.223	10.076
14-Apr-02	2.11	2.100	6.500	5.000
15-Apr-02	0.03	2.325	3.200	2.500
16-Apr-02		2.700	1.000	0.750
17-Apr-02		2.500		
18-Apr-02		2.400		
19-Apr-02	0.78	2.561		
20-Apr-02	0.16	2.357	6.500	6.000
21-Apr-02	1.39	2.350	5.000	4.250
22-Apr-02		2.300	4.000	4.000
23-Apr-02		2.250	2.000	2.000
24-Apr-02	1.47	2.725	6.188	5.756
25-Apr-02		2.725	0.975	0.609
26-Apr-02		2.700	0.072	
27-Apr-02	1.19	2.334	5.944	8.967
28-Apr-02		2.506	1.435	2.740
29-Apr-02		2.500	0.039	
30-Apr-02		2.400	0.008	
Totals	9.48	71.012	54.098	59.06
Average		2.367	3.381	4.543
No. of Overflow Days			16	13

Date	Precipitation Inches	Influent Flow MGD	North CSO Overflow Volume MGD	South CSO Overflow Volume MGD
1-May-02	0.01	2.686		
2-May-02	0.43	2.600		
3-May-02		2.700		
4-May-02		2.715		
5-May-02	0.03	2.458		
6-May-02	0.51	2.799	4.616	4.500
7-May-02	0.64	2.659	0.318	1.000
8-May-02	0.16	2.701	4.386	5.000
9-May-02	0.04	2.570	0.581	1.000
10-May-02		2.447	0.100	0.500
11-May-02		2.000		0.050
12-May-02	1.27	2.600	1.227	1.750
13-May-02	0.32	2.647	6.222	7.000
14-May-02		2.947	1.186	1.250
15-May-02		2.814	0.059	0.750
16-May-02	0.16	2.924		
17-May-02	0.37	3.192		
18-May-02		2.869		2.000
19-May-02		2.741		1.000
20-May-02		2.592		
21-May-02		2.750		
22-May-02		2.425		
23-May-02		1.900		
24-May-02		1.525		
25-May-02		0.934		
26-May-02		1.400		
27-May-02		1.400		
28-May-02		1.658		
29-May-02	1.50	2.250	1.218	0.012
30-May-02		2.348	0.050	
31-May-02		2.320		
Totals	5.44	74.571	19.963	25.812
Average		2.406	1.815	1.986
No. of Overflow Days			11	13

Date	Precipitation Inches	Influent Flow MGD	North CSO Overflow Volume MGD	South CSO Overflow Volume MGD
1-Jun-02		1.801		
2-Jun-02		1.448		
3-Jun-02		1.363		
4-Jun-02	0.24	1.594		
5-Jun-02	0.11	2.000		
6-Jun-02	0.54	2.513	1.250	1.000
7-Jun-02		2.260		
8-Jun-02		2.057		
9-Jun-02		1.738		
10-Jun-02		1.342		
11-Jun-02	0.04	1.278		
12-Jun-02	0.15	1.390		
13-Jun-02	0.30	2.183		
14-Jun-02		1.810		
15-Jun-02		1.699		
16-Jun-02	0.02	1.315		
17-Jun-02	0.06	1.222		
18-Jun-02		1.129		
19-Jun-02		1.122		
20-Jun-02		1.120		
21-Jun-02		1.138		
22-Jun-02		1.131		
23-Jun-02		1.139		
24-Jun-02	0.01	1.175		
25-Jun-02	0.02	1.092		
26-Jun-02		0.858		
27-Jun-02	0.65	0.900		
28-Jun-02	0.45	1.800	1.500	1.250
29-Jun-02		1.751		
30-Jun-02		1.238		
Totals	2.59	44.606	2.750	2.250
Average		1.487	1.375	1.125
No. of Overflow Days			2	2

Date	Precipitation Inches	Influent Flow MGD	North CSO Overflow Volume MGD	South CSO Overflow Volume MGD
1-Jul-02		1.531		
2-Jul-02		1.507		
3-Jul-02		1.641		
4-Jul-02		1.242		
5-Jul-02		1.164		
6-Jul-02	0.04	1.184		
7-Jul-02		1.056		
8-Jul-02		1.052		
9-Jul-02	0.22	1.286		
10-Jul-02	0.10	1.215		
11-Jul-02		1.071		
12-Jul-02		1.015		
13-Jul-02		1.295		
14-Jul-02		1.038		
15-Jul-02		1.511		
16-Jul-02		1.063		
17-Jul-02	0.28	1.503		
18-Jul-02	1.42	1.762		
19-Jul-02		1.863		
20-Jul-02		1.862		
21-Jul-02		1.306		
22-Jul-02		1.123		
23-Jul-02	0.06	1.771		
24-Jul-02		1.239		
25-Jul-02		1.189		
26-Jul-02		1.209		
27-Jul-02		1.151		
28-Jul-02		1.093		
29-Jul-02		1.369		
30-Jul-02	0.33	1.164		
31-Jul-02		1.542		
Totals	2.45	41.017	0.000	0.000
Average		1.323		
No. of Overflow Days			0	0

Date	Precipitation Inches	Influent Flow MGD	North CSO Overflow Volume MGD	South CSO Overflow Volume MGD
1-Aug-02		1.226		
2-Aug-02		1.090		
3-Aug-02		1.111		
4-Aug-02		1.094		
5-Aug-02		1.094		
6-Aug-02		1.089		
7-Aug-02		0.552		
8-Aug-02		0.861		
9-Aug-02		1.114		
10-Aug-02		1.131		
11-Aug-02		1.105		
12-Aug-02		1.116		
13-Aug-02	0.35	1.500		
14-Aug-02	0.22	2.200		
15-Aug-02		1.591		
16-Aug-02		1.386		
17-Aug-02		1.159		
18-Aug-02		1.187		
19-Aug-02	0.10	1.200		
20-Aug-02		1.193		
21-Aug-02		1.158		
22-Aug-02		1.195		
23-Aug-02		1.400		
24-Aug-02	0.12	1.383		
25-Aug-02		1.139		
26-Aug-02		1.155		
27-Aug-02		1.132		
28-Aug-02		1.118		
29-Aug-02		1.110		
30-Aug-02		1.140		
31-Aug-02		1.241		
Totals	0.79	37.170	0.000	0.000
Average		1.199		
No. of Overflow Days			0	0

Date	Precipitation Inches	Influent Flow MGD	North CSO Overflow Volume MGD	South CSO Overflow Volume MGD
1-Sep-02		1.097		
2-Sep-02		1.122		
3-Sep-02		1.155		
4-Sep-02		1.166		
5-Sep-02		1.145		
6-Sep-02		1.143		
7-Sep-02		1.474		
8-Sep-02		1.100		
9-Sep-02		1.211		
10-Sep-02		1.150		
11-Sep-02		1.169		
12-Sep-02		1.124		
13-Sep-02		1.144		
14-Sep-02		1.310		
15-Sep-02	0.24	1.550		
16-Sep-02		1.100		
17-Sep-02	0.18	1.100		
18-Sep-02	0.65	1.376		
19-Sep-02	1.10	2.500	10.000	8.000
20-Sep-02	1.04	2.524	5.000	3.000
21-Sep-02	0.01	2.524	1.500	0.750
22-Sep-02		1.800	0.500	0.250
23-Sep-02		1.729		
24-Sep-02		1.093		
25-Sep-02		1.069		
26-Sep-02	1.82	2.000	2.000	1.500
27-Sep-02		1.700	0.500	0.300
28-Sep-02	0.04	1.700		
29-Sep-02		1.300		
30-Sep-02		1.300		
Totals	5.08	42.875	19.500	13.800
Average		1.429	3.250	2.300
No. of Overflow Days			6	6
YEAR TOTAL	56.47	666.323	217.495	280.759
YEAR TOTAL NO. OF OVERFLOW DAYS			71	81

ADJUSTED
CSO FLOW DATA
OCTOBER, 2001 THRU SEPTEMBER, 2002
ADJUSTED TO REFLECT ADDITION OF NEW PLANT

Date	Precipitation Inches	Influent Flow MGD	North CSO Overflow Volume MGD	South CSO Overflow Volume MGD
1-Oct-01		0.860		
2-Oct-01		0.830		
3-Oct-01		0.839		
4-Oct-01		0.863		
5-Oct-01	1.05	1.700		
6-Oct-01		1.566		
7-Oct-01		1.530		
8-Oct-01		1.413		
9-Oct-01		0.855		
10-Oct-01	0.07	1.450		
11-Oct-01	1.40	6.800		
12-Oct-01	0.01	2.300		
13-Oct-01	1.13	2.250		
14-Oct-01	0.76	7.250		
15-Oct-01	0.10	2.150		
16-Oct-01		2.050		
17-Oct-01		2.000		
18-Oct-01		1.650		
19-Oct-01		1.450		
20-Oct-01		1.150		
21-Oct-01		1.205		
22-Oct-01		1.496		
23-Oct-01	2.60	9.000	1.780	1.390
24-Oct-01	1.32	9.000	7.260	7.250
25-Oct-01		5.313		
26-Oct-01		3.080		
27-Oct-01		2.700		
28-Oct-01		2.450		
29-Oct-01		1.625		
30-Oct-01		1.400		
31-Oct-01		1.250		
Totals	8.440	79.475	9.040	8.640
Average		2.564	4.520	4.320
No. of Overflow days			2	2

Date	Precipitation Inches	Influent Flow MGD	North CSO Overflow Volume MGD	South CSO Overflow Volume MGD
1-Nov-01		1.100		
2-Nov-01	0.04	1.250		
3-Nov-01		1.366		
4-Nov-01		1.328		
5-Nov-01		1.299		
6-Nov-01		1.192		
7-Nov-01		1.214		
8-Nov-01		1.198		
9-Nov-01		1.254		
10-Nov-01		1.100		
11-Nov-01		1.124		
12-Nov-01		1.097		
13-Nov-01		1.244		
14-Nov-01		1.116		
15-Nov-01		1.126		
16-Nov-01		1.100		
17-Nov-01		1.113		
18-Nov-01		1.096		
19-Nov-01	0.29	1.650		
20-Nov-01		1.325		
21-Nov-01		1.103		
22-Nov-01		1.024		
23-Nov-01	0.01	1.043		
24-Nov-01	1.03	7.350		
25-Nov-01		2.500		
26-Nov-01	0.37	2.700		
27-Nov-01	0.38	9.000	16.740	25.690
28-Nov-01	1.74	2.638		
29-Nov-01	1.3	2.400		
30-Nov-01	0.02	2.550		
Totals	5.18	56.600	16.74	25.69
Average		1.887	16.74	25.690
No. of Overflow Days			1	1

Date	Precipitation Inches	Influent Flow MGD	North CSO Overflow Volume MGD	South CSO Overflow Volume MGD
1-Dec-01		2.100		
2-Dec-01		2.000		
3-Dec-01		2.300		
4-Dec-01		2.350		
5-Dec-01		1.729		
6-Dec-01	0.7	9.000	0.826	0.728
7-Dec-01		2.400		
8-Dec-01	0.23	2.850		
9-Dec-01		2.400		
10-Dec-01		2.500		
11-Dec-01		2.300		
12-Dec-01	0.86	9.000	6.630	26.970
13-Dec-01	0.15	2.600		
14-Dec-01	0.37	2.653		
15-Dec-01		2.250		
16-Dec-01	2.37	9.000	5.520	
17-Dec-01	1.95	2.300		
18-Dec-01		2.500		
19-Dec-01	0.01	2.229		
20-Dec-01		2.159		
21-Dec-01		2.400		
22-Dec-01	0.46	7.060		
23-Dec-01	0.08	2.325		
24-Dec-01		2.646		
25-Dec-01		2.402		
26-Dec-01		2.820		
27-Dec-01		2.400		
28-Dec-01		2.200		
29-Dec-01	0.01	1.822		
30-Dec-01		1.722		
31-Dec-01		1.710		
Totals	7.19	96.127	12.976	27.698
Average		3.101	6.593	13.623
No. of Overflow Days			3	2

Date	Precipitation Inches	Influent Flow MGD	North CSO Overflow Volume MGD	South CSO Overflow Volume MGD
1-Jan-02		1.597		1.500
2-Jan-02		1.594		1.010
3-Jan-02		1.570		0.500
4-Jan-02		1.447		
5-Jan-02		1.685		
6-Jan-02	0.26	1.176		
7-Jan-02		1.176		
8-Jan-02		1.610		
9-Jan-02		1.621		
10-Jan-02	0.01	1.573		
11-Jan-02		1.958		
12-Jan-02		1.697		
13-Jan-02		1.541		
14-Jan-02		1.445		
15-Jan-02		1.652		
16-Jan-02		1.395		
17-Jan-02		1.329		
18-Jan-02		1.677		
19-Jan-02	0.24	1.750		
20-Jan-02		1.535		
21-Jan-02		1.642		
22-Jan-02		1.615		
23-Jan-02	0.71	9.000	1.370	3.060
24-Jan-02	0.71	6.030		
25-Jan-02		4.880		
26-Jan-02		3.300		
27-Jan-02		2.214		
28-Jan-02		2.310		
29-Jan-02		2.449		
30-Jan-02		9.000	1.030	1.090
31-Jan-02		9.000	0.065	
Totals	1.93	82.468	2.465	7.160
Average		2.660	0.822	1.432
No. of Overflow Days			3	2

Date	Precipitation Inches	Influent Flow MGD	North CSO Overflow Volume MGD	South CSO Overflow Volume MGD
1-Feb-02		5.900		
2-Feb-02		3.524		
3-Feb-02		2.959		
4-Feb-02		2.594		
5-Feb-02		2.500		
6-Feb-02	0.03	2.678		
7-Feb-02		2.573		
8-Feb-02		2.310		
9-Feb-02		2.350		
10-Feb-02	0.01	2.450		
11-Feb-02		2.050		
12-Feb-02		2.050		
13-Feb-02		1.972		
14-Feb-02		1.480		
15-Feb-02		2.788		
16-Feb-02		1.559		
17-Feb-02		1.417		
18-Feb-02		1.634		
19-Feb-02	0.31	2.000		
20-Feb-02	0.14	2.250		
21-Feb-02		1.900		
22-Feb-02		1.593		
23-Feb-02		1.450		
24-Feb-02		1.400		
25-Feb-02	0.44	1.595		
26-Feb-02	0.01	2.450		
27-Feb-02		2.687		
28-Feb-02		1.800		
Totals	0.94	63.913	0	0
Average		2.283	0	0
No. of Overflow Days			0	0

Date	Precipitation Inches	Influent Flow MGD	North CSO Overflow Volume MGD	South CSO Overflow Volume MGD
1-Mar-02		1.460		
2-Mar-02	0.92	8.249		
3-Mar-02		4.295		
4-Mar-02		2.897		
5-Mar-02		2.450		
6-Mar-02		2.200		
7-Mar-02		2.000		
8-Mar-02		1.600		
9-Mar-02	0.86	6.440		
10-Mar-02		3.811		
11-Mar-02	0.11	3.157		
12-Mar-02	0.01	3.080		
13-Mar-02		2.417		
14-Mar-02		2.250		
15-Mar-02	0.75	3.561		
16-Mar-02		8.879		
17-Mar-02	0.03	4.296		
18-Mar-02	0.08	3.511		
19-Mar-02	1.69	9.000	1.540	1.900
20-Mar-02	0.51	9.000	6.180	7.050
21-Mar-02		6.330		
22-Mar-02		4.040		
23-Mar-02		2.458		
24-Mar-02	0.01	2.260		
25-Mar-02	1.31	9.000	0.780	1.330
26-Mar-02	0.31	9.000	6.460	5.720
27-Mar-02		5.940		
28-Mar-02	0.01	3.868		
29-Mar-02	0.36	5.060		
30-Mar-02		3.672		
31-Mar-02		2.903		
Totals	6.96	139.084	14.960	16.000
Average		4.487	3.740	4.000
No. of Overflow Days			4	4

Date	Precipitation Inches	Influent Flow MGD	North CSO Overflow Volume MGD	South CSO Overflow Volume MGD
1-Apr-02		2.525		
2-Apr-02	0.16	2.500		
3-Apr-02		2.300		
4-Apr-02		2.300		
5-Apr-02		2.100		
6-Apr-02		2.300		
7-Apr-02		2.000		
8-Apr-02	0.36	2.000		
9-Apr-02	0.01	2.100		
10-Apr-02		2.300		
11-Apr-02		2.000		
12-Apr-02	0.50	9.000	0.160	1.018
13-Apr-02	1.32	9.000	6.740	6.650
14-Apr-02	2.11	9.000	2.600	2.000
15-Apr-02	0.03	8.025		
16-Apr-02		4.430		
17-Apr-02		2.500		
18-Apr-02		2.400		
19-Apr-02	0.78	2.561		
20-Apr-02	0.16	9.000	3.040	2.820
21-Apr-02	1.39	9.000	1.400	1.200
22-Apr-02		9.000	0.650	0.650
23-Apr-02		6.250		
24-Apr-02	1.47	9.000	2.940	2.670
25-Apr-02		4.309		
26-Apr-02		2.772		
27-Apr-02	1.19	9.000	3.290	4.960
28-Apr-02		6.680		
29-Apr-02		2.539		
30-Apr-02		2.408		
Totals	9.48	71.012	54.098	59.06
Average		2.367	3.381	4.543
No. of Overflow Days			8	8

Date	Precipitation Inches	Influent Flow MGD	North CSO Overflow Volume MGD	South CSO Overflow Volume MGD
1-May-02	0.01	2.686		
2-May-02	0.43	2.600		
3-May-02		2.700		
4-May-02		2.715		
5-May-02	0.03	2.458		
6-May-02	0.51	9.000	1.480	1.440
7-May-02	0.64	3.977		
8-May-02	0.16	9.000	1.440	1.640
9-May-02	0.04	4.151		
10-May-02		3.047		
11-May-02		2.050		
12-May-02	1.27	5.577		
13-May-02	0.32	9.000	3.230	3.640
14-May-02		5.383		
15-May-02		3.623		
16-May-02	0.16	2.924		
17-May-02	0.37	3.192		
18-May-02		4.869		
19-May-02		3.741		
20-May-02		2.592		
21-May-02		2.750		
22-May-02		2.425		
23-May-02		1.900		
24-May-02		1.525		
25-May-02		0.934		
26-May-02		1.400		
27-May-02		1.400		
28-May-02		1.658		
29-May-02	1.50	3.480		
30-May-02		2.398		
31-May-02		2.320		
Totals	5.44	107.475	6.15	6.72
Average		3.467	2.050	2.240
No. of Overflow Days			3	3

Date	Precipitation Inches	Influent Flow MGD	North CSO Overflow Volume MGD	South CSO Overflow Volume MGD
1-Jun-02		1.801		
2-Jun-02		1.448		
3-Jun-02		1.363		
4-Jun-02	0.24	1.594		
5-Jun-02	0.11	2.000		
6-Jun-02	0.54	4.763		
7-Jun-02		2.260		
8-Jun-02		2.057		
9-Jun-02		1.738		
10-Jun-02		1.342		
11-Jun-02	0.04	1.278		
12-Jun-02	0.15	1.390		
13-Jun-02	0.30	2.183		
14-Jun-02		1.810		
15-Jun-02		1.699		
16-Jun-02	0.02	1.315		
17-Jun-02	0.06	1.222		
18-Jun-02		1.129		
19-Jun-02		1.122		
20-Jun-02		1.120		
21-Jun-02		1.138		
22-Jun-02		1.131		
23-Jun-02		1.139		
24-Jun-02	0.01	1.175		
25-Jun-02	0.02	1.092		
26-Jun-02		0.858		
27-Jun-02	0.65	0.900		
28-Jun-02	0.45	4.550		
29-Jun-02		1.751		
30-Jun-02		1.238		
Totals	2.59	49.606	0.000	0.000
Average		1.654	0	0
No. of Overflow Days			0	0

Date	Precipitation Inches	Influent Flow MGD	North CSO Overflow Volume MGD	South CSO Overflow Volume MGD
1-Jul-02		1.531		
2-Jul-02		1.507		
3-Jul-02		1.641		
4-Jul-02		1.242		
5-Jul-02		1.164		
6-Jul-02	0.04	1.184		
7-Jul-02		1.056		
8-Jul-02		1.052		
9-Jul-02	0.22	1.286		
10-Jul-02	0.10	1.215		
11-Jul-02		1.071		
12-Jul-02		1.015		
13-Jul-02		1.295		
14-Jul-02		1.038		
15-Jul-02		1.511		
16-Jul-02		1.063		
17-Jul-02	0.28	1.503		
18-Jul-02	1.42	1.762		
19-Jul-02		1.863		
20-Jul-02		1.862		
21-Jul-02		1.306		
22-Jul-02		1.123		
23-Jul-02	0.06	1.771		
24-Jul-02		1.239		
25-Jul-02		1.189		
26-Jul-02		1.209		
27-Jul-02		1.151		
28-Jul-02		1.093		
29-Jul-02		1.369		
30-Jul-02	0.33	1.164		
31-Jul-02		1.542		
Totals	2.45	41.017	0.000	0.000
Average		1.323		
No. of Overflow Days			0	0

Date	Precipitation Inches	Influent Flow MGD	North CSO Overflow Volume MGD	South CSO Overflow Volume MGD
1-Aug-02		1.226		
2-Aug-02		1.090		
3-Aug-02		1.111		
4-Aug-02		1.094		
5-Aug-02		1.094		
6-Aug-02		1.089		
7-Aug-02		0.552		
8-Aug-02		0.861		
9-Aug-02		1.114		
10-Aug-02		1.131		
11-Aug-02		1.105		
12-Aug-02		1.116		
13-Aug-02	0.35	1.500		
14-Aug-02	0.22	2.200		
15-Aug-02		1.591		
16-Aug-02		1.386		
17-Aug-02		1.159		
18-Aug-02		1.187		
19-Aug-02	0.10	1.200		
20-Aug-02		1.193		
21-Aug-02		1.158		
22-Aug-02		1.195		
23-Aug-02		1.400		
24-Aug-02	0.12	1.383		
25-Aug-02		1.139		
26-Aug-02		1.155		
27-Aug-02		1.132		
28-Aug-02		1.118		
29-Aug-02		1.110		
30-Aug-02		1.140		
31-Aug-02		1.241		
Totals	0.79	37.170	0.000	0.000
Average		1.199		
No. of Overflow Days			0	0

Date	Precipitation Inches	Influent Flow MGD	North CSO Overflow Volume MGD	South CSO Overflow Volume MGD
1-Sep-02		1.097		
2-Sep-02		1.122		
3-Sep-02		1.155		
4-Sep-02		1.166		
5-Sep-02		1.145		
6-Sep-02		1.143		
7-Sep-02		1.474		
8-Sep-02		1.100		
9-Sep-02		1.211		
10-Sep-02		1.150		
11-Sep-02		1.169		
12-Sep-02		1.124		
13-Sep-02		1.144		
14-Sep-02		1.310		
15-Sep-02	0.24	1.550		
16-Sep-02		1.100		
17-Sep-02	0.18	1.100		
18-Sep-02	0.65	1.376		
19-Sep-02	1.10	9.000	6.390	5.110
20-Sep-02	1.04	9.000	0.950	0.570
21-Sep-02	0.01	4.770		
22-Sep-02		2.550		
23-Sep-02		1.729		
24-Sep-02		1.093		
25-Sep-02		1.069		
26-Sep-02	1.82	5.500		
27-Sep-02		2.500		
28-Sep-02	0.04	1.700		
29-Sep-02		1.300		
30-Sep-02		1.300		
Totals	5.08	63.147	7.340	5.680
Average		2.105	3.670	2.840
No. of Overflow Days			2	2
ANNUAL TOTAL	56.47	887.094	123.769	156.648
ANNUAL TOTAL NO. OF OVERFLOW DAYS			26	24

City of Boonville
Pam Hendrickson, Mayor
P. O. BOX 585 · BOONVILLE, IN 47601
PH: (812) 897-1230 · FAX: (812) 897-6545

Honorable Pam Hendrickson, Mayor
Members Board of Public Works
City of Boonville
P.O. Box 585
Boonville, IN 47601

Re: L.T.C.P.
Sensitive Areas

Dear Mayor Hendrickson and Members of Board of Works:

The Citizens Advisory Committee named by Mayor Hendrickson, has reviewed the City's CSO discharge points; have reviewed the Cypress Creek watershed; and have reviewed existing reports and published data.

After discussion of the impact of Booneville's CSO's have upon:

a. Habitat for threatened and endangered species.
b. Primary contact recreation areas.
c. Drinking water sources.
d. OSRW and ONRW

It is our recommendation that the City designate the following sensitive areas:

1. The High School Athletic fields are located just East of the North CSO Basins. We recommend that the culverts under the North CSO influent sewer be properly maintained to reduce flooding on the Athletic field. We also recommend that the North CSO Basin remain fenced and that the North CSO Basin be operated as efficiently as possible.

2. The Jr. High School facilities located just south of the South CSO Basin. We recommend that the South CSO discharge remain enclosed from the CSO Basin to Cypress Creek to limit accessibility and that the South CSO Basin remain fenced. We also recommend that the South CSO Basin be operated as efficiently as possible.

3. We do not recommend that Cypress Creek be considered a sensitive area.

Thank you for this opportunity to provide input to the City. We look forward to future discussions of the City's CSO alteration and financial impacts.

Sincerely yours,
LTCP CITIZENS ADVISORY COMMITTEE

Mr. Ron Tubbs

Mr. Steve Byers

Mr. Rob Burton

Mr. Robert Stone

ALTERNATIVES TO BE CONSIDERED

Alternative 1-A	Complete Separation North CSO Basin.
Alternative 1-B	Complete Separation South CSO Basin.
Alternative 1-C	Complete Separation of Both North and South Basins.
Alternative 2-A	Screening & Disinfection of North CSO Basin.
Alternative 2-B	Screening & Disinfection of South CSO Basin.
Alternative 2-C	Screening & Disinfection of Both CSO Basins.
Alternative 3-A	Screening North CSO Basin.
Alternative 3-B	Screening South CSO Basin.
Alternative 3-C	Screening Both CSO Basins.

City of Boonville *Pam Hendrickson, Mayor*

P. O. BOX 585 · BOONVILLE, IN 47601
PH: (812) 897-1230 · FAX: (812) 897-6545

Honorable Pam Hendrickson, Mayor
Members Board of Public Works
City of Boonville
P.O. Box 585
Boonville, IN 47601

Re: L.T.C.P.
Sensitive Areas

Dear Mayor Hendrickson and Members of Board of Works:

The Citizens Advisory Committee named by Mayor Hendrickson, has reviewed the City's CSO discharge points; have reviewed the Cypress Creek watershed; and have reviewed existing reports and published data.

After discussion of the impact of Booneville's CSO's have upon:

a. Habitat for threatened and endangered species.
b. Primary contact recreation areas.
c. Drinking water sonrces.
d. OSRW and ONRW

It is our recommendation that the City designate the following sensitive areas:

1. The High School Athletic fields are located just East of the North CSO Basins. We recommend that the culverts under the North CSO influent sewer be properly maintained to reduce flooding on the Athletic field. We also recommend that the North CSO Basin remain fenced and that the North CSO Basin be operated as efficiently as possible.

2. The Jr. High School facilities located just south of the South CSO Basin. We recommend that the South CSO discharge remain enclosed from the CSO Basin to Cypress Creek to limit accessibility and that the South CSO Basin remain fenced. We also recommend that the South CSO Basin be operated as efficiently as possible.

3. We do not recommend that Cypress Creek be considered a sensitive area.

Thank you for this opportunity to provide input to the City. We look forward to future discussions of the City's CSO alteration and financial impacts.

Sincerely yours,
LTCP CITIZENS ADVISORY COMMITTEE

Ronald Tubbs
Mr. Ron Tubbs

Steve Byers
Mr. Steve Byers

Michael Frode for
Mr. Rob Burton
Robert Burton

Robert Stone
Mr. Robert Stone

FOURTH MEETING

12-23-02

ALTERNATIVE 1 - A COMPLETE SEPARATION NORTH CSO

ESTIMATED CONSTRUCTION COST	$21,120,000.00
ESTIMATED NON-CONSTRUCTION COST	$5,280,000.00
TOTAL PROJECT COST	**$26,400,000.00**
ANNUAL CSO VOLUME REDUCED	124 MG/YR
UNDISINFECTED VOLUME REMAINING	156 MG/YR
UNSCREENED VOLUME REMAINING	156 MG/YR

ALTERNATIVE 1 - B COMPLETE SEPARTATION SOUTH CSO

ESTIMATED CONSTRUCTION COST	$30,240,000.00
ESTIMATED NON-CONSTRUCTION COST	$7,560,000.00
TOTAL PROJECT COST	**$37,800,000.00**
ANNUAL CSO VOLUME REDUCED	156 MG/YR
UNDISINFECTED VOLUME REMAINING	124 MG/YR
UNSCREENED VOLUME REMAINING	124 MG/YR

ALTERNATIVE 1 - C COMPLETE SEPARATION NORTH & SOUTH CSO

ESTIMATED CONSTRUCTION COST	$51,360,000.00
ESTIMATED NON-CONSTRUCTION COST	$12,840,000.00
TOTAL PROJECT COST	**$64,200,000.00**
ANNUAL CSO VOLUME REDUCED	280 MG/YR
UNDISINFECTED VOLUME REMAINING	0 MG/YR
UNSCREENED VOLUME REMAINING	0 MG/YR

ALTERNATIVE 2 - A COMPLETE SCREENING & DISINFECTED NORTH CSO

ESTIMATED CONSTRUCTION COST	
SCREENING	$500,000.00
DISINFECTION	$1,400,000.00
SUB-TOTAL CONSTRUCTION COST	$1,900,000.00
ESTIMATED NON-CONSTRUCTION COST	$380,000.00
TOTAL PROJECT COST	**$2,280,000.00**
ANNUAL CSO VOLUME REDUCED	0 MG/YR
UN DISINFECTED VOLUME REMAINING	156 MG/YR
UN SCREENED VOLUME REMAINING	156 MG/YR

ALTERNATIVE 2 - B SCREENING & DISINFECTION SOUTH CSO

ESTIMATED CONSTRUCTION COST	
SCREENING	$500,000.00
DISINFECTION	$1,400,000.00
SUB -TOTAL CONSTRUCTION COST	$1,900,000.00
ESTIMATED NON-CONSTRUCTION COST	$380,000.00
TOTAL PROJECT COST	**$2,280,000.00**
ANNUAL CSO VOLUME REDUCED	0 MG/YR
UNDISINFECTED VOLUME REMAINING	124 MG/YR
UNSCREENED VOLUME REMAINING	124 MG/YR

ALTERNATIVE 2 - C SCREENING & DISINFECTION NORTH & SOUTH CSO

ESTIMATED CONSTRUCTION COST	
SCREENING	$1,000,000.00
DISINFECTION	$2,800,000.00
SUB -TOTAL CONSTRUCTION COST	$3,800,000.00
ESTIMATED NON-CONSTRUCTION COST	$760,000.00
TOTAL PROJECT COST	**$4,560,000.00**
ANNUAL CSO VOLUME REDUCED	0 MG/YR
UNDISINFECTED VOLUME REMAINING	0 MG/YR
UNSCREENED VOLUME REMAINING	0 MG/YR

ALTERNATIVE 3 - A SCREENING NORTH CSO

ESTIMATED CONSTRUCTION COST	$500,000.00
ESTIMATED NON-CONSTRUCTION COST	$100,000.00
TOTAL PROJECT COST	**$600,000.00**

ANNUAL CSO VOLUME REDUCED	0 MG/YR
UNDISINFECTED VOLUME REMAINING	280 MG/YR
UNSCREENED VOLUME REMAINING	156 MG/YR

ALTERNATIVE 3 - B SCREENING SOUTH CSO

ESTIMATED CONSTRUCTION COST	$500,000.00
ESTIMATED NON-CONSTRUCTION COST	$100,000.00
TOTAL PROJECT COST	**$600,000.00**

ANNUAL CSO VOLUME REDUCED	0 MG/YR
UNDISINFECTED VOLUME REMAINING	280 MG/YR
UNSCREENED VOLUME REMAINING	124 MG/YR

ALTERNATIVE 3 - C SCREENING NORTH & SOUTH CSO

ESTIMATED CONSTRUCTION COST	$1,000,000.00
ESTIMATED NON-CONSTRUCTION COST	$200,000.00
TOTAL PROJECT COST	**$1,200,000.00**

ANNUAL CSO VOLUME REDUCED	0 MG/YR
UNDISINFECTED VOLUME REMAINING	280 MG/YR
UNSCREENED VOLUME REMAINING	0 MG/YR

		Alternate 1-A Separation North CSO	
		Construction Costs	Operation Costs
Base Line CSO Volume Estimates after new plant			
CSO Volume	260 MG/yr		
CSO Volume screened	0 MG/yr		
CSO Volume disinfected	0 MG/yr		
North CSO Basin			
Complete Separation		26,400,000.00	
Disnifection and screening		-	
Screening only		-	
CSO Volume	0 MG/yr		
CSO Volume screened	0 MG/yr		
CSO Volume disinfected	0 MG/yr		
South CSO Basin			
Complete Separation		-	
Disnifection and screening		-	
Screening only		-	
CSO Volume	156 MG/yr		
CSO Volume screened	0 MG/yr		
CSO Volume disinfected	0 MG/yr		
Total Project Costs		$ 26,400,000.00	
Total Volume Estimates after CSO improvements			
CSO Volume remaining	156 MG/yr		
CSO Volume screened	0 MG/yr		
CSO Volume disinfected	0 MG/yr		
Total Treatment Cost Estimate			
Year 2003 Annual Revenue Requirements per H.J Humbaugh Report			2,189,823.00
Screening maintneance cost $ 1.00 /1000 gal	0 MG/yr		-
Disinfection Treatment Cost $ 2.00 /1000 gal	0 MG/yr		-
MS4 annual cost			150,000.00
Debt service LTCP 5% Bond issue CRF =	0.08024259		2,118,404.38
Debt service reserve (at 25%)			529,601.09
Total Estimated Annual Revenue Requirements			4,987,828.47
Less Current Revenue			(2,189,823.00)
Increase required			2,798,005.47
Percent increase			128%
Estimated monthly rate for 5,000 gallons			77.90
Present Worth Analysis			
Present Worth Construction Costs			26,400,000.00
Presnet Worth Operation Costs (pwf =	10.29		51,324,754.96
Total Present Worth			77,724,754.96

		Alternate 1-B Separation South CSO	
		Construction Costs	Operation Costs
Base Line CSO Volume Estimates after new plant			
CSO Volume	280 MG/yr		
CSO Volume screened	0 MG/yr		
CSO Volume disinfected	0 MG/yr		
North CSO Basin			
Complete Separation			
Disnifection and screening		-	
Screening only		-	
CSO Volume	124 MG/yr		
CSO Volume screened	0 MG/yr		
CSO Volume disinfected	0 MG/yr		
South CSO Basin			
Complete Separation		37,800,000.00	
Disnifection and screening		-	
Screening only		-	
CSO Volume	0 MG/yr		
CSO Volume screened	0 MG/yr		
CSO Volume disinfected	0 MG/yr		
Total Project Costs		$ 37,800,000.00	
Total Volume Estimates after CSO improvements			
CSO Volume remaining	124 MG/yr		
CSO Volume screened	0 MG/yr		
CSO Volume disinfected	0 MG/yr		
Total Treatment Cost Estimate			
Year 2003 Annual Revenue Requirements per H.J Humbaugh Report			2,189,823.00
Screening maintneance cost	0 MG/yr		-
$ 1.00 /1000 gal			
Disinfection Treatment Cost	0 MG/yr		-
$ 2.00 /1000 gal			
MS4 annual cost			150,000.00
Debt service LTCP 5% Bond issue CRF =	0.08024259		3,033,169.90
Debt service reserve (at 25%)			758,292.48
Total Estimated Annual Revenue Requirements			6,131,285.38
Less Current Revenue			(2,189,823.00)
Increase required			3,941,462.38
Percent Increase			180%
Estimated monthly rate for 5,000 gallons			95.76
Present Worth Analysis			
Present Worth Construction Costs			37,800,000.00
Presnet Worth Operation Costs (pwf =	10.29		63,090,926.53
Total Present Worth			100,890,926.53

		Alternate 1-C Separation North and South CSO	
		Construction Costs	Operation Costs
Base Line CSO Volume Estimates after new plant			
CSO Volume	260 MG/yr		
CSO Volume screened	0 MG/yr		
CSO Volume disinfected	0 MG/yr		
North CSO Basin			
Complete Separation		26,400,000.00	
Dianifection and screening		-	
Screening only		-	
CSO Volume	0 MG/yr		
CSO Volume screened	0 MG/yr		
CSO Volume disinfected	0 MG/yr		
South CSO Basin			
Complete Separation		37,800,000.00	
Disnifection and screening		-	
Screening only		-	
CSO Volume	0 MG/yr		
CSO Volume screened	0 MG/yr		
CSO Volume disinfected	0 MG/yr		
Total Project Costs		$ 64,200,000.00	
Total Volume Estimates after CSO improvements			
CSO Volume remaining	0 MG/yr		
CSO Volume screened	0 MG/yr		
CSO Volume disinfected	0 MG/yr		
Total Treatment Cost Estimate			
Year 2003 Annual Revenue Requirements per H.J Humbaugh Report			2,189,823.00
Screening maintneance cost	0 MG/yr		-
$ 1.00 /1000 gal			
Disinfection Treatment Cost	0 MG/yr		-
$ 2.00 /1000 gal			
MS4 annual cost			150,000.00
Debt service LTCP 5% Bond issue CRF =	0.08024259		5,151,574.28
Debt service reserve (at 25%)			1,287,893.57
Total Estimated Annual Revenue Requirements			8,779,290.85
Less Current Revenue			(2,189,823.00)
Increase required			6,589,467.85
Percent Increase			301%
Estimated monthly rate for 5,000 gallons			137.11
Present Worth Analysis			
Present Worth Construction Costs			64,200,000.00
Presnet Worth Operation Costs (pwf =	10.29		90,336,902.82
Total Present Worth			154,536,902.82

		Alternate 2-A Screening and Disinfection North CSO	
		Construction Costs	Operation Costs
Base Line CSO Volume Estimates after new plant			
CSO Volume	280 MG/yr		
CSO Volume screened	0 MG/yr		
CSO Volume disinfected	0 MG/yr		
North CSO Basin			
Complete Separation			
Disnifection and screening		2,280,000.00	
Screening only		-	
CSO Volume	156 MG/yr		
CSO Volume screened	156 MG/yr		
CSO Volume disinfected	156 MG/yr		
South CSO Basin			
Complete Seperation			
Disnifection and screening		-	
Screening only		-	
CSO Volume	124 MG/yr		
CSO Volume screened	0 MG/yr		
CSO Volume disinfected	0 MG/yr		
Total Project Costs		$ 2,280,000.00	
Total Volume Estimates after CSO improvements			
CSO Volume remaining	280 MG/yr		
CSO Volume screened	156 MG/yr		
CSO Volume disinfected	156 MG/yr		
Total Treatment Cost Estimate			
Year 2003 Annual Revenue Requirements per H.J Humbaugh Report			2,189,823.00
Screening maintneance cost $ 1.00 /1000 gal	156 MG/yr		156,000.00
Disinfection Treatment Cost $ 2.00 /1000 gal	156 MG/yr		312,000.00
MS4 annual cost			150,000.00
Debt service LTCP 5% Bond issue CRF =	0.08024259		182,953.11
Debt service reserve (at 25%)			45,738.28
Total Estimated Annual Revenue Requirements			3,036,514.38
Less Current Revenue			(2,189,823.00)
Increase required			846,691.38
Percent increase			39%
Estimated monthly rate for 5,000 gallons			47.42
Present Worth Analysis			
Present Worth Construction Costs			2,280,000.00
Presnet Worth Operation Costs (pwf =	10.29		31,245,732.99
Total Present Worth			33,525,732.99

		Alternate 2-B Screening and Disinfection South CSO	
		Construction Costs	Operation Costs
Base Line CSO Volume Estimates after new plant			
CSO Volume	280 MG/yr		
CSO Volume screened	0 MG/yr		
CSO Volume disinfected	0 MG/yr		
North CSO Basin			
Complete Separation			
Disnifection and screening			
Screening only		-	
CSO Volume	156 MG/yr		
CSO Volume screened	0 MG/yr		
CSO Volume disinfected	0 MG/yr		
South CSO Basin			
Complete Separation			
Disnifection and screening		2,280,000.00	
Screening only		-	
CSO Volume	124 MG/yr		
CSO Volume screened	124 MG/yr		
CSO Volume disinfected	124 MG/yr		
Total Project Costs		$ 2,280,000.00	
Total Volume Estimates after CSO improvements			
CSO Volume remaining	280 MG/yr		
CSO Volume screened	124 MG/yr		
CSO Volume disinfected	124 MG/yr		
Total Treatment Cost Estimate			
Year 2003 Annual Revenue Requirements per H.J Humbaugh Report			2,189,823.00
Screening maintneance cost	124 MG/yr		124,000.00
$ 1.00 /1000 gal			
Disinfection Treatment Cost	124 MG/yr		248,000.00
$ 2.00 /1000 gal			
MS4 annual cost			150,000.00
Debt service LTCP 5% Bond Issue CRF =	0.08024259		182,953.11
Debt service reserve (at 25%)			45,738.28
Total Estimated Annual Revenue Requirements			2,940,514.38
Less Current Revenue			(2,189,823.00)
Increase required			750,691.38
Percent increase			34%
Estimated monthly rate for 5,000 gallons			45.92
Present Worth Analysis			
Present Worth Construction Costs			2,280,000.00
Presnet Worth Operation Costs (pwf =	10.29		30,257,892.99
Total Present Worth			32,537,892.99

	Alternate 2-C Screening and Disinfection North and South CSO	
	Construction Costs	**Operation Costs**
Base Line CSO Volume Estimates after new plant		
CSO Volume 280 MG/yr		
CSO Volume screened 0 MG/yr		
CSO Volume disinfected 0 MG/yr		
North CSO Basin		
Complete Separation		
Disnifection and screening	2,280,000.00	
Screening only	-	
CSO Volume 156 MG/yr		
CSO Volume screened 156 MG/yr		
CSO Volume disinfected 156 MG/yr		
South CSO Basin		
Complete Separation		
Disnifection and screening	2,280,000.00	
Screening only	-	
CSO Volume 124 MG/yr		
CSO Volume screened 124 MG/yr		
CSO Volume disinfected 124 MG/yr		
Total Project Costs	$ 4,560,000.00	
Total Volume Estimates after CSO improvements		
CSO Volume remaining 280 MG/yr		
CSO Volume screened 280 MG/yr		
CSO Volume disinfected 280 MG/yr		
Total Treatment Cost Estimate		
Year 2003 Annual Revenue Requirements per H.J Humbaugh Report		2,189,823.00
Screening maintneance cost 280 MG/yr $ 1.00 /1000 gal		280,000.00
Disinfection Treatment Cost 280 MG/yr $ 2.00 /1000 gal		560,000.00
MS4 annual cost		150,000.00
Debt service LTCP 5% Bond issue CRF = 0.08024259		365,906.21
Debt service reserve (at 25%)		91,476.55
Total Estimated Annual Revenue Requirements		3,637,205.76
Less Current Revenue		(2,189,823.00)
Increase required		1,447,382.76
Percent increase		66%
Estimated monthly rate for 5,000 gallons		56.80
Present Worth Analysis		
Present Worth Construction Costs		4,560,000.00
Presnet Worth Operation Costs (pwf = 10.29		37,426,847.30
Total Present Worth		41,986,847.30

		Alternate 3-A Screening North CSO	
		Construction Costs	Operation Costs
Base Line CSO Volume Estimates after new plant			
CSO Volume	280 MG/yr		
CSO Volume screened	0 MG/yr		
CSO Volume disinfected	0 MG/yr		
North CSO Basin			
Complete Separation			
Disinfection and screening			
Screening only		600,000.00	
CSO Volume	156 MG/yr		
CSO Volume screened	156 MG/yr		
CSO Volume disinfected	0 MG/yr		
South CSO Basin			
Complete Separation			
Disinfection and screening			
Screening only		-	
CSO Volume	124 MG/yr		
CSO Volume screened	0 MG/yr		
CSO Volume disinfected	0 MG/yr		
Total Project Costs		$ 600,000.00	
Total Volume Estimates after CSO improvements			
CSO Volume remaining	280 MG/yr		
CSO Volume screened	156 MG/yr		
CSO Volume disinfected	0 MG/yr		
Total Treatment Cost Estimate			
Year 2003 Annual Revenue Requirements per H.J Humbaugh Report			2,189,823.00
Screening maintneance cost $ 1.00 /1000 gal	156 MG/yr		156,000.00
Disinfection Treatment Cost $ 2.00 /1000 gal	0 MG/yr		-
MS4 annual cost			150,000.00
Debt service LTCP 5% Bond issue CRF =	0.08024259		48,145.55
Debt service reserve (at 25%)			12,036.39
Total Estimated Annual Revenue Requirements			2,556,004.94
Less Current Revenue			(2,189,823.00)
Increase required			366,181.94
Percent increase			17%
Estimated monthly rate for 5,000 gallons			39.92
Present Worth Analysis			
Present Worth Construction Costs			600,000.00
Presnet Worth Operation Costs (pwf =	10.29		26,301,290.86
Total Present Worth			26,901,290.86

		Alternate 3-B Screening North CSO	
		Construction Costs	Operation Costs
Base Line CSO Volume Estimates after new plant			
CSO Volume	280 MG/yr		
CSO Volume screened	0 MG/yr		
CSO Volume disinfected	0 MG/yr		
North CSO Basin			
Complete Separation			
Disnifection and screening			
Screening only		-	
CSO Volume	156 MG/yr		
CSO Volume screened	0 MG/yr		
CSO Volume disinfected	0 MG/yr		
South CSO Basin			
Complete Separation			
Disnifection and screening			
Screening only		600,000.00	
CSO Volume	124 MG/yr		
CSO Volume screened	124 MG/yr		
CSO Volume disinfected	0 MG/yr		
Total Project Costs		$ 600,000.00	
Total Volume Estimates after CSO improvements			
CSO Volume remaining	280 MG/yr		
CSO Volume screened	124 MG/yr		
CSO Volume disinfected	0 MG/yr		
Total Treatment Cost Estimate			
Year 2003 Annual Revenue Requirements per H.J Humbaugh Report			2,189,823.00
Screening maintneance cost	124 MG/yr		124,000.00
$ 1.00 /1000 gal			
Disinfection Treatment Cost	0 MG/yr		-
$ 2.00 /1000 gal			
MS4 annual cost			150,000.00
Debt service LTCP 5% Bond issue CRF =	0.08024259		48,145.55
Debt service reserve (at 25%)			12,036.39
Total Estimated Annual Revenue Requirements			2,524,004.94
Less Current Revenue			(2,189,823.00)
Increase required			334,181.94
Percent increase			15%
Estimated monthly rate for 5,000 gallons			39.42
Present Worth Analysis			
Present Worth Construction Costs			600,000.00
Prasnet Worth Operation Costs (pwf =	10.29		25,972,010.86
Total Present Worth			26,572,010.86

		Alternate 3-C Screening North and South CSO	
		Construction Costs	Operation Costs
Base Line CSO Volume Estimates after new plant			
CSO Volume	280 MG/yr		
CSO Volume screened	0 MG/yr		
CSO Volume disinfected	0 MG/yr		
North CSO Basin			
Complete Separation			
Disnifection and screening			
Screening only		600,000.00	
CSO Volume	156 MG/yr		
CSO Volume screened	124 MG/yr		
CSO Volume disinfected	0 MG/yr		
South CSO Basin			
Complete Separation			
Disnifection and screening			
Screening only		600,000.00	
CSO Volume	124 MG/yr		
CSO Volume screened	124 MG/yr		
CSO Volume disinfected	0 MG/yr		
Total Project Costs		$ 1,200,000.00	
Total Volume Estimates after CSO improvements			
CSO Volume remaining	280 MG/yr		
CSO Volume screened	248 MG/yr		
CSO Volume disinfected	0 MG/yr		
Total Treatment Cost Estimate			
Year 2003 Annual Revenue Requirements per H.J Humbaugh Report			2,189,823.00
Screening maintneance cost	248 MG/yr		248,000.00
$ 1.00 /1000 gal			
Disinfection Treatment Cost	0 MG/yr		-
$ 2.00 /1000 gal			
MS4 annual cost			150,000.00
Debt service LTCP 5% Bond issue CRF =	0.08024259		96,291.11
Debt service reserve (at 25%)			24,072.78
Total Estimated Annual Revenue Requirements			2,708,186.89
Less Current Revenue			(2,189,823.00)
Increase required			518,363.89
Percent increase			24%
Estimated monthly rate for 5,000 gallons			42.30
Present Worth Analysis			
Present Worth Construction Costs			1,200,000.00
Presnet Worth Operation Costs (pwf =	10.29		27,867,243.05
Total Present Worth			29,067,243.05

Ranking of Alternatives by Volume CSO Removed

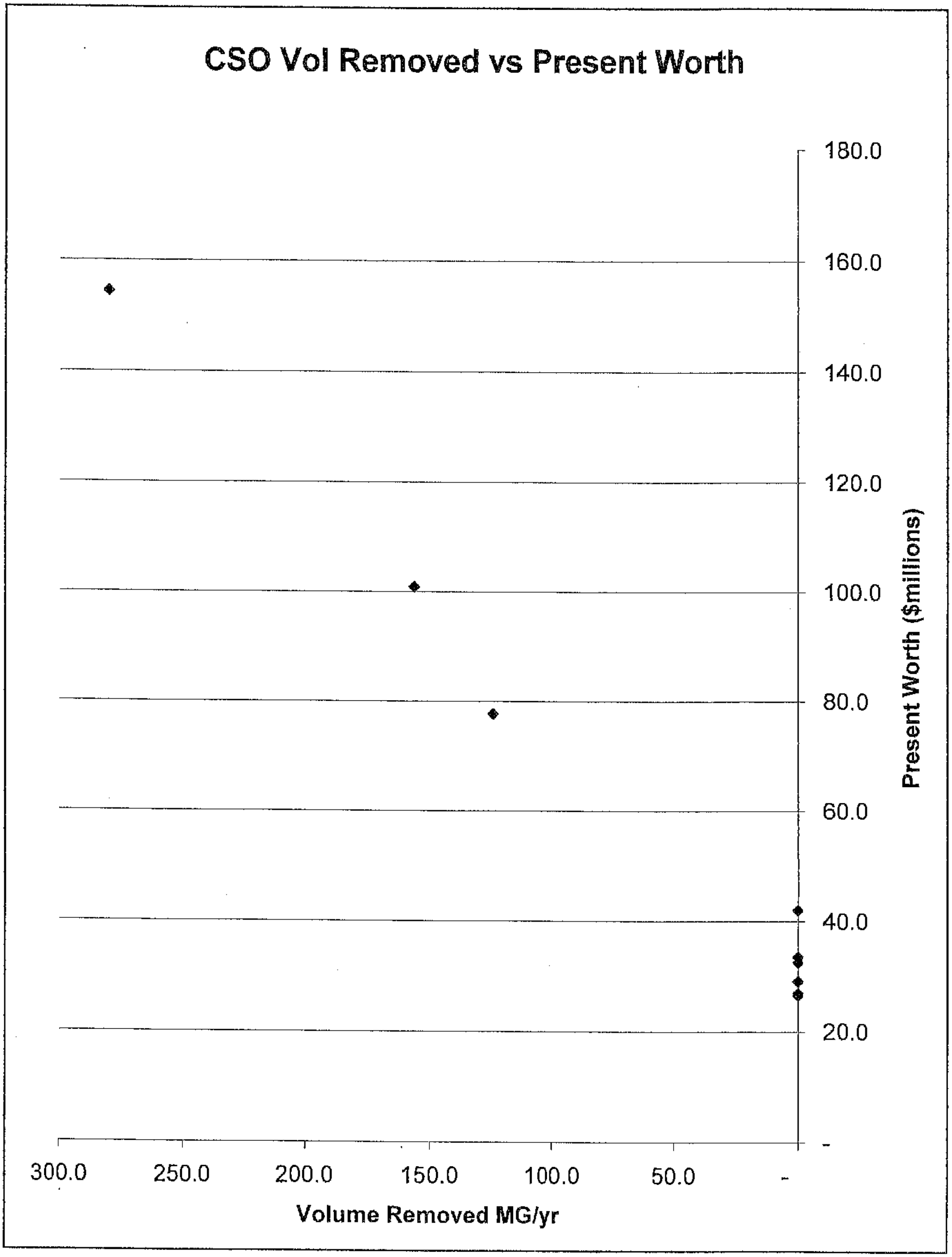
	CSO Volume Remaining MG/Yr	CSO Volume Removed MG/Yr	CSO Volume Screened MG/Yr	CSO Volume Disinfected and Screened MG/Yr	Present Worth $ Millions
Alternative 1-C	-	280.0	-	-	154.5
Alternative 1-B	124.0	156.0	-	-	100.9
Alternative 1-A	156.0	124.0	-	-	77.7
Alternative 2-A	280.0	-	156.0	156.0	33.5
Alternative 2-B	280.0	-	124.0	124.0	32.5
Alternative 2-C	280.0	-	280.0	280.0	42.0
Alternative 3-A	280.0	-	156.0	-	26.9
Alternative 3-B	280.0	-	124.0	-	26.6
Alternative 3-C	280.0	-	280.0	-	29.1

Ranking of Alternatives by Volume CSO Screened

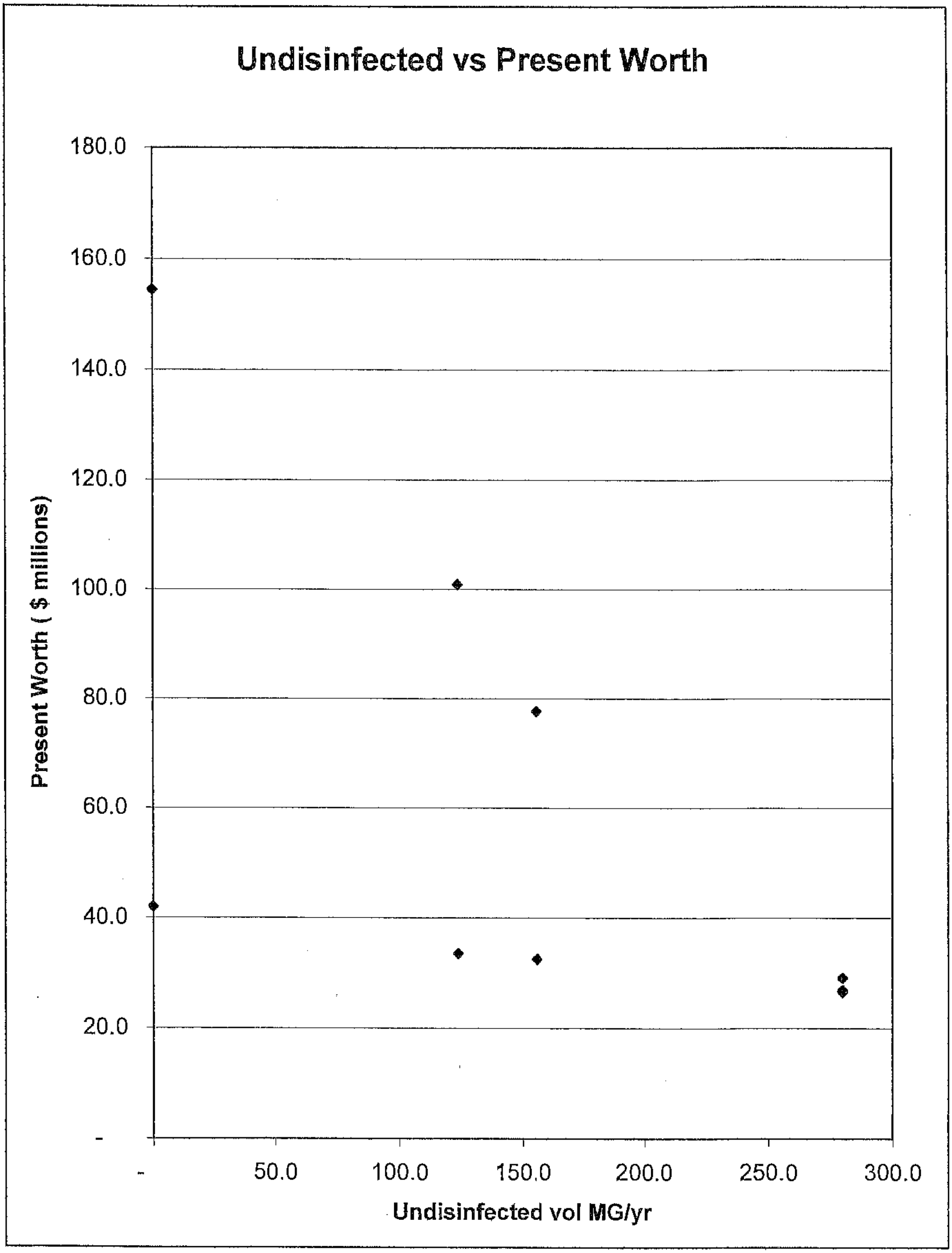
	CSO Volume Remaining MG/Yr	CSO Volume Removed MG/Yr	CSO Volume Screened MG/Yr	CSO Volume Disinfected and Screened MG/Yr	Present Worth $ Millions
Alternative 2-C	280.0	-	280.0	280.0	42.0
Alternative 3-C	280.0	-	280.0	-	29.1
Alternative 2-A	280.0	-	156.0	156.0	33.5
Alternative 3-A	280.0	-	156.0	-	26.9
Alternative 2-B	280.0	-	124.0	124.0	32.5
Alternative 3-B	280.0	-	124.0	-	26.6
Alternative 1-C	-	280.0	-	-	154.5
Alternative 1-B	124.0	156.0	-	-	100.9
Alternative 1-A	156.0	124.0	-	-	77.7

Ranking of Alternatives by Volume CSO Disinfected and Screened

	CSO Volume Remaining MG/Yr	CSO Volume Removed MG/Yr	CSO Volume Screened MG/Yr	CSO Volume Disinfected and Screened MG/Yr	Present Worth $ Millions
Alternative 2-C	280.0	-	280.0	280.0	42.0
Alternative 2-A	280.0	-	156.0	156.0	33.5
Alternative 2-B	280.0	-	124.0	124.0	32.5
Alternative 3-C	280.0	-	280.0	-	29.1
Alternative 3-A	280.0	-	156.0	-	26.9
Alternative 3-B	280.0	-	124.0	-	26.6
Alternative 1-C	-	280.0	-	-	154.5
Alternative 1-B	124.0	156.0	-	-	100.9
Alternative 1-A	156.0	124.0	-	-	77.7



CSO Vol Removed vs Present Worth
180.0
160.0
140.0
120.0
100.0
80.0
60.0
40.0
20.0
-
Present Worth ($millions)
300.0
250.0
200.0
150.0
100.0
50.0
-
Volume Removed MG/yr



Undisinfected vs Present Worth
180.0
160.0
140.0
120.0
100.0
80.0
60.0
40.0
20.0
-
Present Worth ($ millions)
-
50.0
100.0
150.0
200.0
250.0
300.0
Undisinfected vol MG/yr

Section 9 - Financial Capability

9-A Wastewater Cost Per Household Indicator

The initial step in the analysis of the Financial Capability involves the calculation of a generalized benchmark that relates the LTCP costs and current wastewater costs to the CSO municipality's Median Household Income on an annualized basis. This Benchmark is called the Wastewater cost per Household Indicator or WW_{CPHI} as follows:

For purposes of the section the annualized cost per household is taken as annual cost of operation plus annual debt service divided by the number of households as enumerated by the 2000 Census (2,910).

$$WW_{CPHI} = \frac{\text{Annualized LTCP and Existing Wastewater costs per household}}{\text{Annualized Median Household Income}} \times 100\%$$

From the Census Bureau
  the 2000 Median Household Income for Boonville was $34,913
  the 2000 Median Household Income for the nation was $42,148

For the various alternatives which bracket the "Knee of the curve" a matrix of WW_{CPHI} values can be calculated as presented in Table 9-1. Using the Criteria in the guidance, the overall economic impact per household can be determined using WW_{CPHI} value. A value <1% is rated as "low", a value of 1% to 2% is rated as "medium" and values >2% are rated as "high". The impact ratings for the various alternatives are shown in the last column of the Table.

Table 9-1

Alternative	Annual WW cost	Per Household	WW_{CPHI}	Economic impact
Beyond The Knee				
1C	$ 8,779,290.00	$ 3,016.00	8.6%	"High"
2C	$ 3,637,205.00	$ 1,249.00	3.6%	"High"
Below Knee				
3C	$ 2,706,000.00	$ 930.00	2.7%	"High"
~~Alternative 4G~~	~~$ 5,395,000.00~~	~~$ 1,158.00~~	~~4.0%~~	~~"High"~~

For all alternatives labeled as "high" the socio-economic impact shall be considered widespread.

9-B Socio-Economic Indicators Matrix (SEIM)

For WW_{CPHI} with a result greater than 1% a scoring matrix is set up to consider additional economic factors external to the actual project costs. This is labeled the Socio-Economic Indicator Matrix (SEIM). This index considers several indicators of economic health. These are put into a matrix that is presented in Table 9-2

Median Household Income

From the previous section the City of Boonville has an estimated year 2000 Median Household income of $ 34,913. The National MHI for 2000 was $42,148

Rating basis
- Weak: >25% below the National MHI
- Mid-Range: + or – 25% of the National MHI
- Strong: > 25% above the National

Boonville's MHI is 17% lower than the National MHI and is rated as "mid-range"

Average Unemployment Rate for 2000

The average unemployment rate for Boonville in year 2000 was 3.5%. The National average 4.0% from US Bureau of Labor Statistics.

Rating basis
- Weak: >1 % above National average
- Mid-Range: + or – 1% of the National average
- Strong: > 1% below the National average

Boonville's average is 0.5% below the National MHI and is rated as "mid-range"

Overall Net Debt per Capita

The Overall Net Debt per capita for Boonville was $1,094.44 (from rate accountant)

Rating basis
- Weak: >3,000
- Mid-Range: 1,000 – 3,000
- Strong: < 1,000

Boonville's Net Debt rating is "mid-range"

Bond Rating

The City of Boonville's Wastewater Utility is not rated. Use midrange for calculating the SEIM.

Property Tax Revenue Collection Rate

The property Tax Collection rate for Boonville was 99.9%

Rating basis
Weak: <94%
Mid-Range: 4% to 98%
Strong: > 98%

Washington's Property tax collection rating is "strong"

Table 9-2 S-E Indicators Matrix Worksheet

S-E Indicator Matrix	Municipality Value	Weak, Mid-Range, or Strong	Municipality Score
Median Household Income	$ 34,913	Mid-Range	2
Tax Collection Rate	99.09%	Strong	1
Bond Rating	Non-rated	Mid-Range	2
Overall Net Debt Per Capita	$ 1,094.00	Mid-Range	2
Average Unemployment Rate, Year 2000	3.5%	Mid-Range	2
S-E Indicator Matrix Total			9
SEIM AVERAGE			1.8
S-E-I Matrix Strength Rating			Mid-Range

9-C Overall Financial Capability Matrix and Implementation Schedule

The Overall Financial Capability Matrix and Implementation Timeline Table represents the substantial economic burden realized by Washington to fully implement the Long Term Control Plan. Table 9-3 has been prepared to display this matrix for each of the alternatives located near the "knee of the curve". The methodology used to determine the implementation schedule is based upon a combination of the SEIM average from Table 9-2, and the WW_{CPH} calculated for each Alternative in Table 9-1. Table 9-4 displays the solution Matrix used to assign the appropriate implementation schedule. The results indicate that an appropriate implementation schedule would be in the range of 10 to 20 years to reach knee of curve.

Table 9-3

Alternative	S-E Indicator Score	WW_{CPH}	Financial Capability Matrix Score	Length of time for LTCP Implementation Schedule
1C	1.8	8.6%	High	10-20 years
2C	1.8	3.6%	High	10-20 years
3C	1.8	2.7%	High	10-20 years

Table 9-4

	S-E Indicator Score	WW_{CPH} Below 1%	WW_{CPH} 1% to 2%	WW_{CPH} Above 2%%
	Above 2.5	Medium	High	High
	1.5 to 2.5	Low	Medium	High
	Below 1.5	Low	Low	Medium

Based upon the scores from this table the Length of Time for LTCP Implementation Schedule can be approximated as follows

High = 10-20 years
Medium = 5-10 years
Low = 5 years

MINUTES OF 1-22-03 MEETING

BOONVILLE L.T.C.P.
CITIZEN ADVISORY COMMITTEE
MINUTES OF JANUARY 22, 2003

Mayor Hendrickson called meeting to order. Members present being Mayor Hendrickson, David Dahl, Michael Frade, Robert Stone, Steve Byers, Rob Burton, Ron Tubbs, Dennis Shreve, R.C. Barnett.

The minutes of the December 11, 2002 meeting were reviewed and approved with the correction of the next meeting date which is January 22, 2003.

Mayor Hendrickson asked if any of the members had any concerns or questions.

Robert Stone voiced his concerns of possible flooding of the athletic fields by the south CSO and Jr. High complex.

It was duly noted and discussed.

Mayor Hendrickson asked if there were any citizen comments. Let the record show that no citizens were present.

There being no further discussion the meeting was adjourned.

CSO NOTIFICATION PLAN

BOONVILLE – PUBLIC NOTIFICATON PROCEDURE

A. GENERAL INFORMATION

The City of Boonville has implemented the Public Notification Procedure outlined in this section. Boonville's procedure has been developed to implement 327 IAC 5-2.1-1

B. PURPOSE OF THE PUBLIC NOTIFICATION PROCEDURE

The purpose of this procedure concerning community notification of potential health impacts resulting from a combined sewer overflow discharge is to promote and accomplish the following:

(1) Educate the public, in general, and those persons who, specifically, may come into contact with water that may be affected by a combined sewer overflow discharge as to the health implications possible from combined sewer overflow discharge tainted water.

(2) Alert members of the public who may be immediately affected by a combined sewer overflow discharge or the potential for a combined sewer overflow discharge to occur.

(3) Enable members of the public to protect themselves from possible exposure to waterborne pathogens resulting from contact with or ingestion of water from a waterway that may be affected by a combined sewer overflow discharge.

C. DEFINITIONS

(1) "Affected public" means those persons who may be exposed to waterborne pathogens through direct contact with or ingestion of water affected by a combined sewer overflow discharge and is limited to:

(a) Residents on or adjacent to affected waters; (Listed at table PNP-1)

(b) Public and private schools on or adjacent to affected waters; (None known to City)

(c) Owners or operators of facilities that provide access to or recreational opportunities in or on affected waters; (None known to the City)

(d) Owners or operators of public drinking water systems with surface intakes in or on affected water. (None known to City)

(2) "Affected waters" means those waters where the E-Coli criteria may be exceeded due to a combined sewer overflow discharge. In general Cypress Creek from 2000 Feet North of SR62 to CR 150 South.

(3) "Combined sewage" means a combination of wastewater, including domestic, commercial, or industrial wastewater and storm water transported in a combined sewer.

(4) "Combined sewer overflow community" or "CSO community" means a recipient of a National Pollutant Discharge Elimination System (NPDES) permit that includes one (1) or more combined sewer overflow outfalls. (City of Boonville)

(5) "Combined sewer overflow discharge" or "CSO discharge" means the discharge of combined sewage from an overflow point listed in a NPDES permit.

(6) "Combined sewer overflow outfall" or "CSO outfall" means a structure that:

(a) Conveys combined sewage into a receiving water body; and

(b) Is listed in an NPDES permit

(7) "Combined sewer system" means a system that:

(a) Is designed, constructed, and used to receive and transport combined sewage to a publicly owned wastewater treatment plant; and

(b) May contain one (1) or more combined sewer overflow outfalls that discharge sewage when the hydraulic capacity of the wastewater treatment plant, combined sewer system, or part of the system is exceeded as a result of a wet weather event.

D. DETERMINATION OF AFFECTED WATERS

For the purposes of this procedure the affected waters are:

(1) Cypress Creek from 2000 ft. North of SR62 downstream to CR 150 South.

Figure PNP-1 displays the affected waters included under this procedure.

E. LOCATIONS OF

(a) The CSO outfalls-These are noted on Figure PNP-1

(b) Public access points include boat launches and bridges. These have been noted on Figure PNP-1 and include:

1. Millersburg Road Bridge
2. Old STP Site
3. SR62 Bridge
4. Bridge near SR62
5. Railroad Bridge near CR 300 W
6. CR 300 West Bridge
7. CR 150 South Bridge

(c) Parks, schoolyards, parkways, and greenways on or adjacent to affected waters. None of these facilities are known to exist on or adjacent to the affected waters. Warrick County Schools – Boonville High School and Boonville Junior High School are nearby.

(d) Drinking water supplies having surface water intakes located then (10) river miles downstream of each CSO outfall. There are no surface water intakes on the affected waters known as Cypress Creek downstream to its confluence with the Ohio River (over 10 river miles).

City of Boonville Pam Hendrickson Mayor

P. O. BOX 585 - BOONVILLE, IN 47601
PH: (812) 897-1230 - FAX: (812) 897-6545

CERTIFICATION OF THE (PUBLIC NOTIFICATION PLAN)

The State of Indiana required the (CITY OF BOONVILLE) to prepare and submit a (public Notification Plan and incorporate same in the City's CSO OPERATION PLAN). Pursuant to 327 IAC 5-5-22 (b-d) and 327 5-2-8 (14), reports required by the NPDES permit must be signed by a duly authorized representative for the municipality, as detailed in the previously mentioned rule citations, and must include the following statement to serve as certification for this report.

"I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for the gathering of the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations."

Date:

3-30-04

Duly Authorized Representative Title:

Mayor

Duly Authorized Representative Signature:

Pam Hendrickson

Comment 2 - The PNP does not mention if the chosen notification procedure is mutually agreeable to the recipient and the CSO community. Please describe how the plan was/will be presented to the public.

Response 2 - The plan provides for a Public Notice to be placed in the paper every March, and mailed to all affected parties. The potential recipient may choose either phone or email notification. In November 2003 this procedure was followed.

The plan provides for two (2) types of notification that the City, as the CSO community, finds agreeable. The recipient may then select which method agreeable to them. Either method is a reasonable, effective means.

In the revised P.N.P. the City has modified this procedure to allow the recipient an opportunity to suggest other notification means. The City will review other suggestions, if any are agreeable to the City they will be incorporated into our plan.

Sincerely,

City of Boonville

Pam Hendrickson

Pam Hendrickson, Mayor

Enclosures

F. METHOD TO PROVIDE NOTIFICATION

Boonville's Notification Procedure consists of the following steps:

(a) Identification of Affected Parties

A list of property owners located on or adjacent to the affected waters has been prepared from courthouse data and is presented in Table PNP- 1. Each year in February this list will be updated and a current list will be maintained in the operation plan. This list will also include operators of all known facilities providing public access to Cypress Creek. The list also includes operators of all known public drinking water systems located within 10 river miles of the CSO's, and the Warrick County Health Department.

(b) Preparation of Notification List

In March of every year the city will prepare a master list of those party's requesting notification of imminent or occurring CSO discharges. The procedure to compile this list will be:

1. Post a public notice in the Boonville Standard text of the notice is presented at the end of Section F.

2. Mail a copy of the public notice to everyone listed in updated Table PNP-1.

3. Prepare Notification list

   As parties respond to the public notice and mailer the operator shall compile a list of these to be notified. The list shall be in two parts. The first part shall include those who wish to be contacted by phone and the second shall include those who wish to be contacted by email. These lists shall be compiled and included in the operation plan as Table PNP-2.

   The Warrick County Health Department shall be included in the Notification Lists.

4. Notification

   Whenever a CSO discharge is occurring or about to occur the operator shall phone everyone on the phone list with the following message.

"Warning an overflow from one or more of Boonville's combined sewer overflows is, or is about to occur. Cypress Creek North of SR62 to CR 150 South may contain sewage pollution. Do not swim in, wade in, or drink this water. Should you have questions, or should you no longer wish to receive these warnings call U.S. Filter/Boonville at 812-897-2118"

This call will be made in person or the operator may arrange to use an automatic phone system.

Likewise whenever a CSO discharge is occurring or is about to occur the operator shall send e-mail to everyone on the e-mail list with a warning message. The text of this message can be found at the end of Section F. This message shall also be emailed to the Warrick County Health Department.

5. When to send Notification

Every morning by 8:00 am the operator on duty will visit each overflow and check the local forecast to determine if an overflow is or is about to occur based upon his judgment. During the day if changed conditions warrant the operator shall issue notice.

6. Documentation

The operator shall maintain a daily log that includes when notification was issued. The log shall also include any overflow events for which no notification was issued. Copies of this log shall be submitted with the monthly MRO's.

7. Notification Responsibility

Michael Frade as Project Manager for U.S. Filter/Boonville has the ultimate responsibilities to implement this Notification procedure. The Project Manager will provide instructions to the on duty operators setting forth when to issue notice, who is to maintain documentation, and who is responsible when the Project Manager is not on duty. The Project Manager will periodically review notification procedure and results and modify as needed to promote the main purpose.

8. Signage

U.S. Filter/Boonville shall coordinate with the Board of Works to provide signage to properly warn the public. The signs shall be the same dimensions as the city information signs. The sign text can be found at the end of Section F.

9. Sign Location

The city shall put these signs at each CSO. At the new WWTP and at the old STP site at intervals along Cypress Creek, at the old STP site.

The city shall offer to post a sign at the following locations:

S.R. 62 Bridge
Railroad Bridge near S.R. 62
County Road 300W Bridge
Railroad Bridge near CR 300W
County Bridge 150 South

The owners of property upstream and downstream of these locations shall be sent a letter offering to post a sign. If the property owners reject the city's offer the city will contact the county for permission to post a sign.

These sign offers shall be renewed every year in March. The text of these offers can be found at the end of Section F.

TABLE PNP-1

LIST OF AFFECTED PARTIES

PART 1 - PROPERTY OWNERS

NAME	MAILING ADDRESS
Kirby Broadview Farms, Inc.	899 Eskew Road Boonville, IN 47601
Robert F. and Marla J. Stone	P.O. Box 561 Boonville, IN 47601
Profile Extrusion Company	P.O. Box 505 Boonville, IN 47601
Baker Corporation	410 State Road 261 Boonville, IN 47601
State of Indiana	100 North Senate Ave. Indianapolis, IN 46204
Aluminum Company of America	P.O. Box 10 Newburgh, IN 47630
George C. and Elanor Roth	11516 Nicholas Street Ste. 100 Omaha, NE 68154
Douglas and Charlotte W. Marsh	46291 Norton Street Northville, MI 48167
Glen E. Rudolph	211 South Yankeetown Road Boonville, IN 47601
Steven M. and Linda L. Wagner	11237 Millersburg Road Chandler, IN 47610
Charles A. and Nancy J. Wagner	10344 Heim Road Chandler, IN 47610
Manfred K. and Donna J. Stahl	7741 Old Boonville Highway Evansville, IN 47715
Robert D. and Nancy Hildenbrand	3977 West Baker Road Boonville, IN 47601

PART 2 - OPERATORS OF PUBLIC ACCESS FACILITY

NAME	FACILITY	MAILING ADDRESS
NONE KNOWN TO EXIST		

PART 3 – OPERATORS P.D.W.S. USING SURFACE INTAKE WITHIN 10 RIVER MILES

NAME	FACILITY	MAILING ADDRESS
NONE KNOWN TO EXIST		

PART 4 – LOCAL HEALTH DEPARTMENT

NAME	FACILITY	MAILING ADDRESS
Warrick County Health Dept.		Old Courthouse Boonville, IN 47601 Phone# 812-897-6105 Email health@warrickcounty.gov

PART 5 – OTHERS EXPRESSING INTEREST

NAME	FACILITY	MAILING ADDRESS
Boonville Standard	Newspaper	P.O. Box 266 Boonville, IN 47601

(To be put in Boonville Paper and again each March)

PUBLIC NOTICE

COMBINED SEWER OVERFLOW NOTIFICATION

Pursuit to 327 IAC 5-2.1-6 The City of Boonville provides public notice to the following parties:

A. All interested media sources, such as newspapers, television, or radio.

B. Affected public
   - All residents on or adjacent to Cypress Creek from 2000 feet North of SR62 to County Road 150 South.
   - Public and private schools on or adjacent to Cypress Creek from 2000 feet North of SR62 to County Road 150 South.
   - Owners or operators of facilities providing access to or recreational opportunities in or on Cypress Creek from 2000 feet North of SR62 to County Road 150 South.
   - Owners and operators of public drinking water systems with surface intakes in or on Cypress Creek from 2000 feet North of SR62 to the Ohio River. The City has no knowledge of the existence of any such water intakes.
   - Warrick County Health Department

C. Other interested persons in the Boonville community

The City of Boonville operates a combined sewer system with two (2) CSO outfalls. These points have been marked with the following signs:

"Caution – Sewage or Wastewater pollution. Sewage or wastewater may be in this water during and for several days after periods of rainfall or snowmelt. People who swim in, wade in, or ingest this water may get sick. For more information, please call U.S. Filter/Boonville 812-897-2118."

As part of its CSO notification plan, when requested, the City of Boonville will provide individual notice of all imminent or occurring CSO overflows. Any party listed above may request individual notice by calling the sanitation dept. to provide your name, mailing address, physical address of affected property, phone number and/or e-mail address to receive notice. Requests for alternate notification methods are encouraged. Please call U.S. Filter/Boonville to offer comments or suggestions or to ask questions. The request for individual notice must be renewed each March. Additional details of the City's notification procedure can be reviewed at the Mayor's office.

TABLE PNP-2

NOTIFICATION LIST

PART A – PHONE CONTACT

The following shall receive a phone notification

Name	Address	Phone Number
Warrick County Health Department	Old Courthouse Boonville, IN 47601	812-897-6105

PART B – E-MAIL CONTACT

The following shall receive an e-mail notification

Name	Address	E-mail
Warrick County Health Department	Old Courthouse Boonville, IN 47601	health@warrickcounty.gov

E-MAIL TEXT

"WARNING"

Conditions indicate that on __________ 20_____ an overflow from one or more of Boonville's combined sewer overflows is, or is about to occur.

Cypress Creek from 2000 feet North of SR 62 to County Road 150 South may contain sewage or wastewater pollution. People who swim in, wade in, or ingest this water may get sick. Should you have questions please call U.S. Filter/Boonville 812-897-2118.

You are receiving this notice because you requested to be placed on the City's notification list. Should you desire to no longer receive these notices send a copy to the Mayor's office at 135 S. 2nd St., Boonville, IN 47601.

____ I no longer wish to receive these notices

____________________	____________________
Print Name	Signature
____________________	____________________
Address	Date

CAUTIONARY SIGN TEXT

"CAUTION"

Sewage or wastewater pollution. Sewage or wastewater pollution may be in this water during and for several days after periods or rainfall or snowmelt. People who swim in, wade in, or ingest this water may get sick. For more information please call U.S. Filter/Boonville
812-897-2118.

Cautionary CSO Sign Offer
Acceptance/Rejection Form

The City of Boonville has offered to place a Cautionary CSO sign on property owned or operated by me located at____
____.

In accordance with 327 IAC 5-2.1-6 I have the right to either allow or disallow Boonville to post a cautionary sign on the above referenced property. After due consideration I hereby

(check one of the following)

______accept the City's offer

______ reject the City's offer

______________________________ Date ____________________
Signature

____
Print Name

OFFER TO POST CAUTIONARY SIGN

Dear____________________________________

You have been identified as the owner or operator of property that provides public access to Cypress Creek at, ____

____.

The City of Boonville's CSO notification procedure and 327 IAC 5-2.1-6, requires posting of cautionary combined sewer overflow signs. The signs are to be posted at:

1) Access points to an affected water, including boat ramps, bridges, parks, and school yards.

2) Along parkways and greenways on or adjacent to affected waters at locations most likely to provide notification to persons who may come into direct contact with the water.

The signs are to have the following text:

"CAUTION"

Sewage or wastewater pollution. Sewage or wastewater pollution may be in this water during and for several days after periods of rainfall or snowmelt. People who swim in, wade in, or ingest this water may get sick. For more information please call the City of Boonville at 812-897-1230.

The IDEM rule 327 IAC 5-2.1-6 states:

"(d) If an access point to an affected water is located on private property or property outside of CSO community's jurisdiction, then a CSO community shall:

(1) Annually offer to provide a sign required under subsection (b) for the owner a operator of the private or non-jurisdictional property; and

(2) Not be required to provide the sign required under subsection (b) provided the owner or operator has refused the community's offer made according to subdivision (1)."

This correspondence serves as Boonville's offer to provide signs for posting on the property identified in the first paragraph. You have the right to accept or to reject the City's sign offer.

For your convenience we have enclosed an acceptance/rejection form and ask that you complete the form and return it in the enclosed stamped and addressed envelope.

Should you have any questions, please call the City of Boonville at 812-897-1230.

Thank you for your help in this matter.

Sincerely

Honorable Pam Hendrickson, Mayor

CSO OVERFLOW NOTIFICATION LOG
Boonville WTTP IN0022420

MONTH OF JAN 2005

The following have requested notification of CSO overflows:

Robert Stone	897-1478	(HAS ASKED TO BE REMOVED LIST
Charles Wagner	925-7400	HAS ASKED TO BE REMOVED FROM LIST
Steve Wagner	867-5508	
Staser Baker	897-2717	

Date of notification	Time of notification
1/1/2005	CONTINUED FROM 12/31/04
3-Jan	7AM
9-Jan-05	8AM
1/13/2005	12:15PM

William W. Page 2-24-05
Plant Operator

CSO OVERFLOW NOTIFICATION LOG
Boonville WTTP IN0022420

MONTH OF FEB 2005

The following have requested notification of CSO overflows:

Robert Stone	897-1478 (HAS ASKED TO BE REMOVED LIST
Charles Wagner	925-7400 HAS ASKED TO BE REMOVED FROM LIST
Steve Wagner	867-5508
Staser Baker	897-2717

Date of notification	Time of notification
2/7/2005	10AM
13-Feb	9:32AM

William A. Pace
Plant operator
15324

CSO OVERFLOW NOTIFICATION LOG
Boonville WTTP IN0022420

MONTH OF MARCH 2005

The following have requested notification of CSO overflows:

Robert Stone	897-1478	(HAS ASKED TO BE REMOVED LIST
Charles Wagner	925-7400	HAS ASKED TO BE REMOVED FROM LIST
Steve Wagner	867-5508	
Staser Baker	897-2717	

Date of notification	Time of notification
28-Mar	8AM

William A. Pace
Plant Operator
15324

CSO OVERFLOW NOTIFICATION LOG
Boonville WTTP IN0022420

MONTH OF APRIL 2005

The following have requested notification of CSO overflows:

Robert Stone 897-1478 (HAS ASKED TO BE REMOVED LIST
Charles Wagner 925-7400 HAS ASKED TO BE REMOVED FROM LIST
Steve Wagner 867-5508
Staser Baker 897-2717

Date of notification	Time of notification
2-Apr	800
12-Apr-05	12:00 AM

CSO OVERFLOW NOTIFICATION LOG
Boonville WTTP IN0022420

MONTH OF MAY 2005

The following have requested notification of CSO overflows:

Robert Stone	897-1478	(HAS ASKED TO BE REMOVED LIST
Charles Wagner	925-7400	HAS ASKED TO BE REMOVED FROM LIST
Steve Wagner	867-5508	
Staser Baker	897-2717	

Date of notification	Time of notification
13-May	7am
20-May-05	9:45am

William A Pace
Plant Operator

CSO OVERFLOW NOTIFICATION LOG
Boonville WTTP IN0022420

MONTH OF JUNE 2005

The following have requested notification of CSO overflows:

Robert Stone	897-1478	(HAS ASKED TO BE REMOVED LIST
Charles Wagner	925-7400	HAS ASKED TO BE REMOVED FROM LIST
Steve Wagner	867-5508	
Staser Baker	897-2717	

Date of notification	Time of notification
10-Jun	1430

William A. Pace
Plant Operator
15324

CSO OVERFLOW NOTIFICATION LOG
Boonville WTTP IN0022420

MONTH OF JULY 2005

The following have requested notification of CSO overflows:

Robert Stone	897-1478	(HAS ASKED TO BE REMOVED LIST
Charles Wagner	925-7400	HAS ASKED TO BE REMOVED FROM LIST
Steve Wagner	867-5508	
Staser Baker	897-2717	

Date of notification	Time of notification
13-Jul	3:15PM
19-Jul-05	7:15AM

William A. Pace 15724
William Pace
MAINT 3rd OPER

CSO OVERFLOW NOTIFICATION LOG
Boonville WTTP IN0022420

MONTH OF AUGUST 2005

The following have requested notification of CSO overflows:

Robert Stone	897-1478	HAS ASKED TO BE REMOMED FROM LIST
Charles Wagner	925-7400	HAS ASKED TO BE REMOVED FROM LIST
Steve Wagner	867-5508	HAS ASKED TO BE REMOVED FROM LIST
Staser Baker	897-2717	

Date of notification	Time of notification
26-Aug	9:30AM
31-Aug-05	8:30AM

William A. Pace 9-19-05
15324

CSO OVERFLOW NOTIFICATION LOG
Boonville WTTP IN0022420

MONTH OF SEPTEMBER 2005

The following have requested notification of CSO overflows:

Robert Stone	897-1478	HAS ASKED TO BE REMOMED FROM LIST
Charles Wagner	925-7400	HAS ASKED TO BE REMOVED FROM LIST
Steve Wagner	867-5508	HAS ASKED TO BE REMOVED FROM LIST
Staser Baker	897-2717	

Date of notification	Time of notification
SEPT 14TH	8:00AM
SEPT 20TH	8:00AM

William Pace
PLANT OPERATOR
15324
William A Pace

CSO OVERFLOW NOTIFICATION LOG
Boonville WTTP IN0022420

MONTH OF OCTOBER 2005

The following have requested notification of CSO overflows:

Robert Stone	897-1478	HAS ASKED TO BE REMOMED FROM LIST
Charles Wagner	925-7400	HAS ASKED TO BE REMOVED FROM LIST
Steve Wagner	867-5508	HAS ASKED TO BE REMOVED FROM LIST
Staser Baker	897-2717	

Date of notification	Time of notification
NO OVERFLOWS OF CSOS IN OCT	

William Pace
PLANT OPERATOR
15324

CSO OVERFLOW NOTIFICATION LOG
Boonville WTTP IN0022420

MONTH OF OCTOBER 2005

The following have requested notification of CSO overflows:

Robert Stone	897-1478	HAS ASKED TO BE REMOMED FROM LIST
Charles Wagner	925-7400	HAS ASKED TO BE REMOVED FROM LIST
Steve Wagner	867-5508	HAS ASKED TO BE REMOVED FROM LIST
Staser Baker	897-2717	

Date of notification	Time of notification
15-Nov	8AM
28-Nov-05	12PM

William A. Pace
15324

APPENDIX "B"

FEBRUARY 28, 2006 RESPONSE LETTER TO IDEM

City of Boonville *Pam Hendrickson, Mayor*

P. O. BOX 585 · BOONVILLE, IN 47601
PH: (812) 897-1230 · FAX: (812) 897-6545

February 23, 2006

Mr. Todd Trinkle OWQ/Wet Weather
Indiana Department of Environmental Management
Office of Water Quality – Mail Code 65-42
100 North Senate Ave.
Indianapolis, IN 46207-2251

Re: Comment Letter dated 8/25/2005
City of Boonville LTCP

Dear Todd:

This letter and enclosures constitute the City of Boonville's response to your Comment Letter of 8/25/2005. We have reviewed our LTCP in light of your comments, our meeting, and our memorandum to you dated 10/19/2005, a second copy of this letter is provided. This second copy is punched and is intended to be, and you are instructed to insert this letter into our LTCP as Appendix B. Certain attachments to this letter are also revisions to our Long Term Control Plan. These are to be inserted into our LTCP where applicable. Instruction pages are provided to clarify where these are to be inserted.

For clarity, this response letter is presented in comment/response format. We begin with your comments presented under your heading "Issues That Need Resolved".

Issues That Need Resolved

Public Participation

Comment A. The LTCP does not include sign-in sheets, agendas, or meeting minutes for public meetings in which the CSO LTCP was discussed. Please submit the documentation listed above for each meeting.

Response A. The LTCP includes "Appendix "A" Public Meeting Records" for an 11/14/02, 11/26/02 and 12/23/02 meeting of the Citizen's Advisory Committee. As discussed in our 10/19/06 memorandum, the LTCP was submitted to IDEM in December 2002, while the Public Hearing was held on January 22, 2003. Attachment 1 to this letter is to be inserted into Appendix A of the LTCP and includes a copy of the meeting minutes and a copy of the sign-in sheet. Notice of this meeting was posted in accordance with the City's normal meeting procedure.

Comment B. The LTCP does not document changes or decisions made in response to public comments. Please submit documentation on this issue.

Response B. The LTCP does document changes made in response to public comments at the CAC meetings held on November 14, and 26, 2002. At these meetings, Mr. Stone, a private individual, provided independent information regarding Cypress Creek and historic flooding. Based upon his input the schools were identified as sensitive areas. No other comments were received from the public that lead to a revision of the plan. Therefore, no other documentation is available to be provided.

Comment C. Please include documentation of the method used to inform rate payers of a public hearing to discuss LTCP related issues.

Response C. The method used to inform the rate payers of public meetings was the method normally followed by the City in announcing all such meetings. Attachment 2 to this letter is an affidavit from the Clerk-Treasurer explaining the City's normal notice procedure. Unfortunately, the late Clerk-Treasurer's failing health led to loss of some meeting records.

Other Response Since the LTCP was submitted (December 2002), the state has adopted rules regarding public notification for CSO communities and events. In response, the City prepared a public notification plan. The City's plan was submitted to IDEM and approved. Attachment 3 to this letter is to be inserted into Appendix A and includes a copy of the City's notification plan and also includes documentation of all notifications which have been issued since adoption of the plan. As a point of interest, the City compiled a list of affected parties and sent information to each offering to notify them of overflow events. Many initially requested notification. Most have now asked to be removed from the notification list.

Characterization and Monitoring of the Combined Sewer System

Comment A. The LTCP documents stream monitoring results and a sampling program outlined in the SRCER. Boonville states on page 3-34 of its LTCP that E. coli was no greater than 4.5 colonies per 100 ml. in samples taken from CSO discharges into Cypress Creek. Based on comparisons to test results from other communities, IDEM believes the sampling results are incorrect and therefore unacceptable. Discharges from CSO basins must meet water quality standards (WQS) including a daily maximum of 235 colonies per 100 ml. for E. coli. Attainment of WQS at both CSO 002 and 003 will require disinfection unless the City of Boonville can document that the existing system achieves E. coli WQS.

Response A. At our meeting and in the Comment letter, we were notified that IDEM believes the information gathered in our SRCER was flawed and unacceptable. The data, which IDEM believes to be flawed, was collected in 2000 and submitted to IDEM on February 1, 2001. IDEM did not question this data until the Comment letter. Having heard nothing to the contrary, the City proceeded with its LTCP, based upon the data. The analyses were performed by an outside lab of samples collected by the City's Staff. It was recognized during preparation of the LTCP that additional data would be required to document the actual operation efficiency of the CSO basins, and to make a final determination that disinfection was needed. In fact, the Rouge River Project concluded that two years of data is required to document operational efficiency. The plan includes costs of both screening and disinfection, as the City anticipated that both might be required.

The City did not start phase one of our LTCP (submitted in December 2002) as we were waiting approval from IDEM, or at least the start of discussions regarding the plan's contents.

In the three years since the report was compiled, several changes have occurred. One change identified at our meeting is that the City is not required to monitor for all parameters regulated by our NPDES permit. After our October meeting, the City began the monitoring contained in Phase 1 of our plan. We will, however, only monitor for TSS, BOD, and E. coli. Our monitoring program will sample the following locations at the frequencies noted.

1. Upstream of bridge over Millersburg Road
   i. dry weather baseline once per quarter
   ii. wet weather during a Comhined Sewer Overflow once a quarter
2. Downstream of POTW and upstream of North CSO
   i. dry weather baseline once per quarter
   ii. wet weather during a Combined Sewer Overflow once a quarter
3. North CSO influent
   i. dry weather baseline once per quarter
   ii. wet weather during a Combined Sewer Overflow twice per month for one quarter, then once a quarter
4. North CSO effluent
   i. dry weather baseline is not applicable
   ii. wet weather during a Combined Sewer Overflow twice per month for one quarter, then once a quarter
5. Upstream of SR 62 bridge
   i. dry weather baseline once per quarter
   ii. wet weather during a Combined Sewer Overflow once a quarter
6. South CSO influent
   i. dry weather baseline is not applicable
   ii. wet weather during a Combined Sewer Overflow once a quarter
7. South CSO effluent
   i. dry weather baseline is not applicable
   ii. wet weather during a Combined Sewer Overflow twice per month for one quarter, then once a quarter
8. Upstream of bridge on CR 300 West
   i. dry weather baseline once per quarter
   ii. wet weather during a Combined Sewer Overflow once a quarter

Grab samples will be collected for stream samples, while composite samples will be collected for CSO Basin influent and effluent samples. Grabs used for composites shall be in the numbers, and at the frequency determined by our staff to best represent the overflow event.

Since our October 2005 meeting, the City has experienced No overflows in October, two overflows in November, one due to 6 inches of rain on the 15th and 16th. The intense rainfall required all City employees to take emergency steps to clear curb inlets, emergency efforts to prevent over topping of the City Lake, and to respond to major tornado damage. Therefore, no samples were collected of the overflow. A smaller overflow event on the 28th was not sampled due to its short duration and continued tornado response efforts. In December and January, the City experienced no overflow events. Lack of sampled overflow events has prevented the City from properly re-evaluating the stream impact. A dry weather sampling was completed on 12/8/05, a copy is provided in Attachment 4 to this letter. BOD and TSS are essentially the same upstream and downstream and are below the plant NPDES limits. E. coli increases downstream of the plant effluent. This increase is anticipated as December is not a disinfection month; therefore the plant effluent is not disinfected.

The baseline results are similar to the baseline results obtained during the SRCER done in 2001.

Efforts are continuing to obtain operational data. An outside vendor has been retained to provide sampling labor in the event of a repeat of a major storm, like that which occurred in November. Likewise, flow meter calibration and documentation has been improved.

Comment B. Use of the conventional rational method to determine peak flow produced by the drainage area included a two-year return. For control sizing, IDEM recommends that a 10 year/1 hour design storm be utilized.

Response B. An additional change, that has occurred since the LTCP was submitted, is the question of design storm. Based upon the Comment letter, IDEM is apparently adopting a 10 year 1 bour design storm for use in evaluating CSO improvements. The LTCP was prepared using a 2" storm based upon analysis of rainfall event frequencies that occur less than 4 times per year. From the DNR website, a ten year 1 hour storm has a total rainfall of 2.19 inches. It would appear that only the storm duration varies from our design storm.

The City was granted small system status by IDEM, and it was our understanding that this status would negate the need for exhaustive system modeling efforts. The Boonville system has been modeled and flow monitored many times; by HNTB in original facilities plan; in the original (Triad) EPA report; by Pitometer Associates; and again in the Master Plan which was approved by IDEM in 1997. In anticipation of the requirement to use a 10 year 1 hour storm, the City revisited these models. Attachment 5 to this report consists of revisions to our LTCP as a result of these re-evaluations.

Evaluation of Alternatives

Comment A. Alternative 2-C recommends retrofitting the North and South CSO basins with screening and disinfection technologies. This alternative is consistent with a CSO treatment facility. IDEM is in the process of developing an approach where during wet weather conditions, CSO Treatment Facilities (High Rate Clarifiers, etc.) are considered to provide an adequate level of control to meet WQS if certain design storm criteria are met. This approach may utilize design storm flows greater than the City proposes. Please see the attached "CSO Treatment Facility" document and provide documentation of the City's capability and feasibility to meet these criteria.

Response A. At the time the LTCP was prepared our new plant had yet to be completed. The plan evaluated the theoretical impact the new plant would have on our overflows. It was estimated that the plant would cause the volume of overflows from the North CSO basin to decrease from 217 MG/yr to 124 MG/yr. The actual results are much better with an overflow volume of 66 MG in 2005.

The South CSO overflow volume was estimated to decrease from 280 MG/yr to 156 MG/yr. The actual results here are also much better with an overflow volume of 70 in 2005.

The total volume of overflows dropped from 497 MG/yr to 136 MG in 2005. The actual improvement represents a 73% drop in total volume of overflows. This measurable decrease in overflow volume nearly satisfies the presumptive requirement of 85% eliminated or captured for primary treatment. Included in these numbers is the overflow that occurred on 11-15-05 and 11-16-05 (major storm and tornado total precipitation 6"). If we exclude the overflow from this abnormal storm the total overflow would have been

North	65.85 – 27.9	=	37.95
South	69.9 – 30.5	=	39.4
			77.34

For a total reduction of 85%. It seems clear that steps taken to date have greatly reduced system overflows.

Since the October 2005 discussions the City's operating staff has revised their method of CSO operation. The method prior to October 2005 was to capture CSO volume in basins, wait for storm to pass then begin operation of return pumps. The new method is to start return pumps immediately and continue return throughout the duration of the overflows. This has produced a noticeable decrease in overflow volumes in October 2005, November 2005, December 2005 and January of 2006.

The City believes that our additional monitoring will demonstrate that the 85% criterion has been met. The City acknowledges, however, that disinfection of the remaining overflows may be needed to satisfy this requirement. Based upon our meeting, the City has revised our LTCP as noted in Attachment 5.

Comment B. The selected CSO controls should allow for cost-effective expansion or retrofitting if additional controls are necessary in the future to attain WQS. Please include this information in the LTCP.

Response B. The revised LTCP (see Attachment 5) states that all work shall be suitable for future expansion or retrofitting.

Maximizing Treatment at the Existing POTW Treatment Plant

Comment A. Please include a description of bottlenecks in the CSS (combined sewer system) and potential methods for control of infiltration and inflow (I/I).

Response A. Refer to revised LTCP presented in Attachment 5.

Comment B. How will growth effect the maximization of flows at the WWTP? It is important for growth to be considered to ensure that flows will not exceed the system capacity outlined in the LTCP. Public input on the effects from growth must also be considered in the development of the LTCP.

Response B. Refer to revised LTCP presented in Attachment 5.

Comment C. Please explain the addition of flows from the equalizations basins to the WWTP and the time it takes to drain the basins. Would a higher pump capacity at the equalization basins allow better WWTP maximization and further limit CSO discharges?

Response C. Refer to revised LTCP presented in Attachment 5. Yes, increased return may allow better WWTP maximization.

Cost/Performance Consideration

Comment A. There is no discussion of how the LTCP implementation will be financed. Please describe how Boonville intends to finance LTCP implementation (SRF funds, other funding sources, selling bonds, increasing sewer rates/fees, raising property taxes, etc.). An estimated monthly user fee should be included in the LTCP.

Response A. The discussion at our meeting regarding funding of the project was rather brief. Please be advised that since 1997 the City has constructed over 12 million dollars in plant and collection system improvements. To date nearly 80% of the City's overflow volume has been eliminated. The LTCP evaluated the cost impact of the alternatives, and calculated a user rate for each. The rates were estimated based upon selling revenue bonds to fund the projects. These numbers can be found in the cost schedules in the LTCP. In our response to the comments the City revised the LTCP to discuss the anticipated funding. Increased Tax revenues are not appropriate for funding capital improvements at Boonville, and no tax monies go into the sewer utility.

Comment B. The impact of future growth in the City of Boonville should be considered. Increased tax revenues and expenses should be taken into account when developing the financial needs for implementation of the LTCP. Please add this information to the plan.

Response B. Future growth was included in the Master Plan submitted by the City in 1997 this growth was also included in the Facilities plan for the STP, approved by IDEM. This growth was included as we evaluated our facilities for the LTCP. See revised LTCP Attachment 5.

Implementation Schedule

Comment A. Has Phase 1 of the implementation schedule commenced? If so, please submit the results to IDEM. It is recommended that the City of Boonville start Phase 1 as an early action project (EAP) and provide the data to IDEM which will be necessary in determining the baseline impact of Boonville's CSO discharge on Cypress Creek. This information is required to determine the necessity for CSO disinfection.

Response A. As was discussed in our October memorandum, the monitoring has begun, however, no overflows have been sampled (see previous responses).

Comment B. Please note that upon approval of the LTCP, the City shall enter into an Agreed order with IDEM to incorporate the implementation of the plan into an enforceable mechanism. When a LTCP implementation schedule exceeds a permit cycle (i.e. five years) an enforceable mechanism is required under IC 13-14-2-6.

Response B. No response required, refer to revised Compliance Schedule in revised LTCP Attachment 5.

Post-Construction Compliance Monitoring

Comment A timeframe for sampling data submittal to IDEM must be included in the LTCP.

Response See revised LTCP Attachment 5.

Operational Plan

Comment The CSO Operational Plan section must also include: information regarding the O & M for the selected CSO control alternative proposed in the LTCP, and when future CSO Operational Plan revisions are proposed. Please submit a revised CSO Operational Plan including all information listed above.

Response See revised LTCP Attachment 5.

General Comments and/or Questions

Comment — A certification statement [pursuant to 327 IAC 5-2-22(b-d) and 327 IAC 5-2-8(14)] must be submitted along with the LTCP.

Response — Revised LTCP and submittal Response letter dated February 28, 2006 are hereby submitted by the City of Boonville, Indiana.

I certify under penalty of law that this letter and its attachments and the LTCP to which they refer and which they modify were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gathered and evaluated the information submitted. Based upon my inquiry of the person who manages the system or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant possibility of fine and imprisonment for knowing violation.

Respectfully Submitted,

Dianni E. Shrene
President City Council, for
Honorable Pam Hendrickson, Mayor
City of Boonville

Enclosures

Attachment 2
Letter Dated
February 28, 2006

INSTRUCTIONS FOR ATTACHMENT 2

The following statement explains the City's Normal Meeting Notice Procedures

City of Boonville
P.O. Box 585
Boonville, IN 47601
PH: (812) 897-1230 · FAX: (812) 897-6545

February 28, 2006

Mr. Todd Trinkle OWQ/Wet Weather
Indiana Department of Environmental Management
Office of Water Quality – Mail Code 65-42
100 North Senate Ave.
Indianapolis, IN 46207-2251

Subject: Long Term Control Plan – Meeting Info

Dear Mr. Trinkle,

I was given the duty by the Board of Works to locate the original advertising or posting of the second meeting of the LTCP Committee. I was able to find the first advertisement of this committee, but unable to locate the second. After some thought, I remembered that it is the City's policy that for such a meetings of this type, the City would post the advertisement on the City's Bulletin Board. Therefore, I am quite certain that is what happened for the second meeting of this committee.

I would like to make note that the City Clerk at the time of these committee meetings, Dixie Sulawske, was battling cancer and has since passed on. So, we were unable to consult with her for additional information.

If I can be of any further service to you on this Long Term Control Plan (LTCP) for the City of Boonville, please feel free to call me at 812-897-6543.

Cordially,

Nancy

Nancy Shull
City Clerk
City of Boonville, IN

Attachment 1
Letter Dated
February 28, 2006

INSTRUCTIONS FOR ATTACHMENT 1

This Attachment consists of a Colored Divider Sheet, minutes of 1-22-03 meeting, and sign in sheet. Insert these three (3) sheets at the back of the LTCP Appendix "A".

Placed in
Appendix "A" as noted
2-28-06

Attachment 3
Letter Dated
February 28, 2006

INSTRUCTION FOR ATTACHMENT 3

This Attachment includes a Colored Divider Sheet, copy of CSO Notification Plan, and copies of issued notification thru end of December 2005. These are to be inserted at the end of Appendix A following information inserted as part of Attachment 1 to this letter.

Placed in Appendix A As Noted 2/28/06

Attachment 4
Letter Dated
February 28, 2006

INSTRUCTION FOR ATTACHMENT 4

This Attachment consists of a copy of the Dry Weather Baseline Data obtained on 12-8-05

Moss McGraw Environmental Laboratory, Inc.
P.O. Box 915 • 503A Fifth Street • Henderson, KY 42419-0915 • (270) 830-7075 • Fax 270-830-7348

ANALYSIS REPORT

Report Date: 12/13/2005

ATTN: Bill Pace
Veolia Water
P.O. Box 57
Boonville, IN 47601

Sample ID: 8339 ID: #1 Millesburg Rd. Bridge Sample Date: 12/08/2005

Test	Analysis Date /By	Method	Result	Units
c Biochemical Oxygen Demand	12/08/2005 @14:00/SC	SM 5210 B	3	mg/L
Total Suspended Solids	12/09/2005 @08:00/SC	SM 2540 D	9	mg/L
E. Coli	12/08/2005 @ 13:05/SC	SM 9222D	40	CFU/100mL

Sample ID: 8340 ID: #2 Downstream Plant Eff. Sample Date: 12/08/2005

Test	Analysis Date /By	Method	Result	Units
c Biochemical Oxygen Demand	12/08/2005 @14:00/SC	SM 5210 B	2	mg/L
Total Suspended Solids	12/09/2005 @08:00/SC	SM 2540 D	5	mg/L
E. Coli	12/08/2005 @ 13:05/SC	SM 9222D	390	CFU/100mL

Sample ID: 8341 ID: #3 Upstream Bridge HW62 Sample Date: 12/08/2005

Test	Analysis Date /By	Method	Result	Units
c Biochemical Oxygen Demand	12/08/2005 @14:00/SC	SM 5210 B	3	mg/L
Total Suspended Solids	12/09/2005 @08:00/SC	SM 2540 D	8	mg/L
E. Coli	12/08/2005 @ 13:05/SC	SM 9222D	240	CFU/100mL

Sample ID: 8342 ID: #4 Upstream Bridge CR 300 Sample Date: 12/08/2005

Test	Analysis Date /By	Method	Result	Units
c Biochemical Oxygen Demand	12/08/2005 @14:00/SC	SM 5210 B	2	mg/L
Total Suspended Solids	12/09/2005 @08:00/SC	SM 2540 D	10	mg/L
E. Coli	12/08/2005 @ 13:05/SC	SM 9222D	>400	CFU/100mL

Quality Control Data:

Analysis	Blank	Standard % Recovery	Duplicate RPD %	Matrix Spike %
cBOD	0.26	98	0.22	N/A
TSS	0	N/A	0	N/A

Moss McGraw Laboratory Certification No. EPA-KY-01003
Submitted By: Stacy Campbell

				Summer	Winter		Summer	Winter
Limitations Permit No. IN 0022420	cBOD	Monthly Avg		20 mg/L	25 mg/L	Weekly Avg	30 mg/L	38 mg/L
Limitations Permit No. IN 0022420	NH3-N	Monthly Avg		1.26 mg/L	1.89 mg/L	Weekly Avg	1.89 mg/L	2.83 mg/L

"Attachment 5 has been placed in proper spot in LTCP"

Placed in LTCP as noted 2-20-02

Attachment 5
Letter Dated
February 28, 2006

INSTRUCTIONS FOR ATTACHMENT 5

1) Attachment 5 includes a Divider Sheet labeled "Appendix B" insert this sheet immediately after "Appendix A" of the LTCP.

2) Attachment 5 includes a punched copy of the City's response letter including Attachments 1, 2, 3, and 4 but not 5. Insert this letter immediately following the "Appendix B" Divider Sheet.

3) Attachment 5 includes the following revised portions of the L.T.C.P. Please place them in the proper location in the 2002 L.T.C.P.

    a) Revised Title Page place in front pocket of L.T.C.P binder.
    b) Revised Cover Page dated February 2006 (first page inside cover)
        Replace existing cover page dated December 2002.
    c) Remove transmittal letter dated December 31, 2002.
    d) Revised Table of Contents numbered i to ii.
        Replace existing Table of Contents numbered i to ii
    e) Section 3 revised Pages 3-1 to 3-68
        Replace entire existing Section 3 Pages 3-1 to 3-37 except
        Retain existing Page 3-30 Figure B-1 renumber as Page 3-57
        Retain existing Page 3-31 Figure B-2 renumber as Page 3-58
    f) Section 4 revised Pages 4-1 to 4-20
        Replace entire Section 4 pages 4-1 to end of Section.
    g) Section 5 revised Pages 5-1 to 5-3
        Replace entire Section 5 Page 5-1.
    h) Section 7 revised Pages 7-1 and three tables
        Replace entire Section 7 pages 7-1 and three tables.
    i) Section 8 revised Pages 8-1, 8-2, three tables and three figures.
        Replace entire Section 8 Pages 8-1, 8-2, three tables and three figures.
    j. Section 9 revised Pages 9-1, 9-2, 9-3, 9-4, 9-5
        Replace entire Section 9 Pages 9-1, 9-2, 9-3, 9-4.
    k) Section 10 revised Pages 10-1, 10-2 and 10-3
        Replace entire Section 10 Pages 10-1, 10-2.

l) Section 12 revised Pages 12-1
    Replace entire Section 12 Page 12-1.

m) Section 13 revised Page 13-1
    Replace entire Section 13 Page 13-1.

n) Section 14 revised Page 14-1 and 14-2
    Replace entire Section 14 Page 14-1 and 14-2.

Attachment 5:
MS4 Application/Plan
Stormwater Program

City of Bastrop, Louisiana:

- Prospective Applicants for a Small Municipal Separate Storm Sewer System General Permit

To: Prospective Applicants for a Small Municipal Separate Storm Sewer System General Permit

Attached is a **Small Municipal Separate Storm Sewer System (MS4) General Permit Notice of Intent (NOI) MS4-G,** for a Louisiana Pollutant Discharge Elimination System (LPDES) permit, authorized under EPA's delegated NPDES program under the Clean Water Act. To be considered complete, every item on the form must be addressed and the last page signed by an authorized company agent. If an item does not apply, please enter "NA" (for *not applicable*) to show that the question was considered.

Two copies (one original and one copy) of your **completed NOI**, each with a marked **U.S.G.S. Quadrangle map** or equivalent attached, should be submitted to:

Department of Environmental Quality
Office of Environmental Services
Post Office Box 4313
Baton Rouge, LA 70821-4313
Attention: Water Permits Division

Please be advised that completion of this NOI may not fulfill all state, federal, or local requirements for this operation.

According to La. R.S. 48:385, any discharge to a state highway ditch, cross ditch, or right-of-way shall require approval from:

Louisiana DOTD Office of Highways Post Office Box 94245 Baton Rouge, LA 70804-9245 (225) 379-1927	AND	Louisiana DHH Office of Public Health Center for Environmental Health Svcs. Post Office Box 4489 Baton Rouge, LA 70821-4489 (225) 342-7395

A copy of the LPDES regulations found in LAC Title 33:Part IX may be obtained from the Department's website at http://deq.louisiana.gov/page/rules-regulations or from the Office of the Secretary, Regulations Development Section, Post Office Box 4301, Baton Rouge, LA 70821-4303, telephone (225) 219-3981.

After review of the NOI and public notice, this Office will issue written notification to those applicants who are accepted for coverage under this general permit.

For questions concerning this NOI, please contact the Water Permits Division at (225) 219-9371. For help regarding completion of this NOI, please contact DEQ Outreach and Small Business Assistance at 1-800-259-2890.

Date 1/7/19 Revised 5/20/19
Agency Interest No. AI 104073
LPDES Permit No. LAR 041005

Please check:
[ ] Initial Permit
[x] Permit Renewal
[ ] Permit Modification

STATE OF LOUISIANA
DEPARTMENT OF ENVIRONMENTAL QUALITY

Office of Environmental Services, Water Permits Division
Post Office Box 4313
Baton Rouge, LA 70821-4313
Telephone: (225) 219-9371

LPDES NOTICE OF INTENT (NOI) TO DISCHARGE STORMWATER ASSOCIATED WITH SMALL MUNICIPAL SEPARATE STORM SEWER SYSTEMS

(Attach additional pages if needed.)

Submittal of this Notice of Intent (NOI) constitutes notice that the entity identified in Section I of this form requests authorization by LDEQ's Small MS4 LPDES General Permit for storm water discharges from a small municipal separate storm sewer system (MS4) in Louisiana. Submittal of the NOI also constitutes notice that the party identified in Section I of this form has read, understands, and meets the eligibility conditions of Part I.B. of the permit; agrees to comply with all applicable terms and conditions of the permit; understands that continued authorization under the permit is contingent on maintaining eligibility for coverage; and understands that the permittee is required to implement a storm water management program. In order to be granted coverage, all information required on this form must be completed. **Two copies of the completed NOI** (one original and two copies) should be mailed to the Water Permits Division at the above address.

The applicant is the municipality or governmental entity for which coverage is requested. Adjoining municipalities or governmental entities may be co-permittees by submitting a joint NOI (please see next paragraph for check box) per LAC 33:IX.2521.B.1. If necessary, attach additional sheets to provide the information in Sections I-VII for each entity.

Please check box if this NOI is part of a joint application: ☐

SECTION I - FACILITY INFORMATION

A. Permit is to be issued to the following:

1. Legal Name of Applicant/Owner City of Bastrop
   Mailing Address PO Box 431
   Bastrop, La Zip Code: 71221
2. Name & Title of Contact Person Henry C Cotton
   Phone 318-283-0250 Fax 318-283-3333 Email mayorhenycotton@cityofbastrop.com

B. Name and address of responsible representative who completed the NOI:

Name & Title Sandra Harris
Company Veolia Water
Phone 318-283-3326 Fax 318-283-7010 Email Sandra.gough@veolia.com

Address PO Box 706, Bastrop, La. 71221

SECTION II – LAC 33.I.1701 REQUIREMENTS

A. Does the company or owner have federal or state environmental permits in other states that are identical to, or of a similar nature to, the permit for which you are applying? (This requirement applies to all individuals, partnerships, corporations, or other entities who own a controlling interest of 50% or more in your company, or who participate in the environmental management of the facility for an entity applying for the permit or an ownership interest in the permit.)

- [X] Permits in Louisiana. List Permit Numbers: LA0020443, LA0020109, AI166085
- [ ] Permits in other states (list states): ________
- [ ] No other environmental permits.

B. Do you owe any outstanding fees or final penalties to the Department? [ ] Yes [X] No

If yes, please explain. ________

C. Is your company a corporation or limited liability company? [ ] Yes [X] No

If yes, is the corporation or LLC registered with the Secretary of State? [ ] Yes* [ ] No

***If yes, attach a copy of your company's Certificate of Registration and/or Certificate of Good Standing from the Secretary of State.**

SECTION III – SMALL MS4 SYSTEM INFORMATION

1. MS4 Name: City of Bastrop- Municipal Separate Storm Sewer System
2. Regulated City(ies), Town(s) or unincorporated area(s): Bastrop

   Coordinates: (provide the coordinates of the City Hall or municipal business office for the MS4)

   Latitude: 32 deg. 776 min. 785 sec. Longitude: -91 deg. 912 min. 645 sec.

   Method of Coordinate Determination: Quad Map

   (Quad Map, Previous Permit, website, GPS)

3. Population served by the MS4 System: 10,881

4. Indicate all water bodies to which the storm sewer system will discharge, to the extent currently known. Estimate the square miles of the MS4 service area. **Attach a USGS 7.5 minute topographic map (or equivalent) and identify all known discharge points (outfalls), receiving waters, and major control structures.** If all discharge points have not yet been identified, this information will become available when the MS4 mapping is complete. At that time, all discharge points must be identified in the Storm Water Management Plan.

   8.91 miles service area.

   Staulkinghead Creek and Horse Bayou

SECTION IV – STORM WATER MANAGEMENT PLAN	
Phase II MS4 **LDEQ Office of Environmental Services** **Water Permits Division**	
Required Information	
Responsible Official(s):	Name and title of person or persons responsible for implementing or coordinating your storm water management program: Sandra Harris, Operations Supervisor, Veolia Water
Telephone:	318-283-3326
Fax:	318-283-7010
Email:	Sandra.gough@veolia.com
Presence of Co-permittee(s):	Are you relying on another governmental entity to satisfy any of your permit obligations? Yes ☐ No XX☐ If yes, please describe: Click here to enter text.

If you are an existing permittee, please attach your SWMP; you will not need to complete Sections V and VI. If you are a new applicant, you may either submit your SWMP or complete Sections V and VI on the following pages for each of the 6 Minimum Control Measures. You may provide the response to items V and VI in a separate document as an attachment to this NOI provided that the attachment fully addresses the 6 Minimum Control Measures and the Measurable Goals. Helpful information and a list of potential best management practices (BMPs) can be found at the EPA website http://www.epa.gov/npdes/stormwater-discharges-municipal-sources **and the document Measurable Goals Guidance for Phase II Small MS4s is available for review at** https://www.epa.gov/sites/production/files/2015-11/documents/measurablegoals_0.pdf.

SECTION V – BMPs USED TO FULFILL EACH MINIMUM CONTROL MEASURE	
Select BMPs used in your program for each Minimum Control Measure by checking boxes in second column:	
Minimum Control Measure 1. Public Education and Outreach on Storm Water Impacts	
Citizen educator volunteers to staff a public education task force	☐
Classroom education on storm water	☐
Educational displays, pamphlets, booklets, and utility stuffers	XX☐
Education on low-impact lawn and garden activities	☐

Education on proper disposal of campground/recreational vehicle/marina waste	☐
Education on proper disposal of household hazardous wastes	XX☐
Education/outreach for commercial activities	☐
Event participation (festivals, etc.) and distribution of educational materials	XX☐
Low impact development (LID)	☐
Pollution prevention education for businesses	XX☐
Promotional giveaways	☐
Proper pet waste management (for example: information, ordinances, signage)	☐
Storm water educational materials	XX☐
Tailoring outreach programs to target specific audiences and communities (for example: restaurants, garages, or individual home septic systems)	☐
Trash management	☐
Tributary signage to increase public awareness of local water resources	☐
Using the media to get the message out (for example: public service announcements)	XX☐
Water conservation practices for homeowners	☐
Others (add text as needed): Click here to enter text.	☐
Minimum Control Measure 2. Public Involvement/Participation in Development and Implementation of Storm Water Program	
Adopt-a-Road programs	☐
Adopt-a-Storm Drain programs	☐
Adopt-a-Stream programs or other volunteer organizations educating the public	☐
Attitude surveys	☐
Citizen complaint hotlines	XX☐
Citizen panel meetings	☐
Community cleanups	XX☐
Educational programs conducted by volunteers	☐
Reforestation programs	☐
Stakeholder meetings	☐
Storm drain stenciling	XX☐
Stream cleanup and monitoring	☐
Volunteer water quality monitoring	☐
Watershed organization meetings	☐
Wetland plantings	☐
Others (add text as needed): Click here to enter text.	☐

<u>Minimum Control Measure 3.</u> Illicit Discharge Detection and Elimination	
Citizen complaint hotline	XX☐
Illegal dumping/illicit discharge hotline	XX☐
Inspection and/or database tracking identifying failing septic systems	☐
Inspection to identify industrial/business/household illicit connections of wastewater to the storm water drainage system	☐
Recycling programs for commonly dumped wastes such as motor oil, antifreeze, pesticides	☐
Sanitary sewer overflows	XX☐
System to inform general public of hazards associated with illegal dischargers and improper disposal of waste	☐
Others (add text as needed): Click here to enter text.	☐

<u>Minimum Control Measure 4.</u> Construction Site Storm Water Runoff Control	
BMP inspection and maintenance	XX☐
Brush barrier	☐
Check dams	☐
Chemical stabilization	☐
Concrete washout areas	☐
Construction entrance stabilization to prevent vehicle tracking	XX☐
Construction sequencing	☐
Construction site inspection by municipal inspectors	XX☐
Contractor certification	☐
Dust control	☐
Erosion control blankets and anchoring devices	☐
Filter berms	☐
General construction site waste management	☐
Geotextiles	☐
Gradient terraces	☐
Grass-lined channels	☐
Land grading	☐
Model ordinances	☐
Mulching	☐
Plan to prioritize construction sites for inspection by municipal inspectors	☐
Requiring erosion/sediment control plans	☐
Riprap	☐

Sediment basins and rock dams	☐
Sediment filters and sediment chambers	☐
Sediment traps	☐
Silt fence perimeter control	XX☐
Sodding	☐
Soil retention and stabilization	☐
Soil roughening	☐
Spill prevention and control plan	☐
Storm drain inlet protection	☐
Temporary diversion dikes	☐
Temporary slope drain	☐
Temporary stream crossings	☐
Vegetated buffers	☐
Wind fences and sand fences	☐
Educational and training measures for construction site operators	XX☐
Others (add text as needed): TMDL-Fecal Coliform.	XX☐
Minimum Control Measure 5. Post-construction Storm Water Management in New Development and Redevelopment	
Alternative pavers	☐
Alternative turnarounds	☐
Alum injection	☐
Bioretention	☐
BMP inspection and maintenance	XX☐
Buffer zones	☐
Catch basins	XX☐
Conservation easements	☐
Dry extended-detention ponds	☐
Elimination of curbs and gutters	☐
Grassed filter strips	☐
Grassed swales	☐
Green parking	☐
Infiltration basin	☐
Infiltration trench	☐

Infrastructure planning	☐
In-line storage	☐
Manufactured products for storm water inlets	☐
Narrower residential streets	☐
On-lot treatment of storm water	☐
Open space design	☐
Ordinances for post-construction runoff	XX☐
Porous pavement	☐
Sand and organic filters	☐
Storm water wetland	☐
Urban forestry	☐
Wet ponds	☐
Zoning: a planning process that identifies storm water program goals, strategies, operation and maintenance (O&M) policies and procedures, and/or enforcement strategies	☐
Others (add text as needed): Click here to enter text.	☐
Minimum Control Measure 6. Pollution Prevention/Good Housekeeping for Municipal Operations	
Alternative discharge options for chlorinated water	☐
Alternative products	☐
Animal carcass collection from roadways	XX☐
Automobile maintenance	☐
Hazardous materials storage	XX☐
Illegal dumping control	XX☐
Low impact landscaping and lawn care	☐
Materials management	☐
Parking lot and street cleaning	XX☐
Pest control	☐
Pet waste collection in public areas	☐
Road salt application and storage	☐
Roadway and bridge maintenance	☐
Septic system controls	☐
Spill response and prevention plans for municipal facilities	XX☐
Storm drain system cleaning	☐
Training program for grounds maintenance and landscaping crews	☐
Used oil recycling	XX☐

Vehicle washing	XX☐
Operation and maintenance (O&M) program that has a goal of preventing or reducing pollutant runoff from municipal operations	XX☐
Others (add text as needed): Dredged Spoils, Debris, Floatables, and Sediments	XX☐

SECTION VI – MEASURABLE GOALS AND BMPs FOR IMPLEMENTATION OF EACH MINIMUM CONTROL MEASURE

For each BMP chosen, list clear and specific measurable goals with starting and ending dates (month and year) in which the MS4 operator began or will begin full implementation of each of the minimum control measures, list the interim milestones (timeframe and quantity to measure, if quantifiable), and provide the frequency of the action (add text as needed or attach separate sheet):

Minimum Control Measure 1. Public Education and Outreach on Storm Water Impacts
List measurable goals for each BMP with start and end dates, interim milestones, and frequency:
BMP PE1. Insert BMP description: Education displays, pamphlets, booklets, and utility stuffers Measurable Goal: Distribute pamphlets at May Madness and North Louisiana Cotton Festival Person(s) or department(s) responsible: Storm water manager. Timeframe/milestones for implementation: May of each year and September of each year.
BMP PE2. Insert BMP description: Education of household wastes. Measurable Goal: Distribute pamphlets at City of Bastrop council meeting. Person(s) or department responsible: Storm water manager. Timeframe/milestones for implementation: March and November meeting the 2nd Thursday of the month.
BMP PE3. Insert BMP description: Event Participation (festival) and distribution of educational materials. Measurable Goal: Distribute pamphlets at May Madness and North Louisiana Cotton Festival. Person(s) or department(s) responsible: Storm water manager. Timeframe/milestones for implementation: May of each year and September of each year.
BMP PE4. Insert BMP description: Pollutions Prevention education for businesses. Measurable Goal: Pamphlet given out during annual inspection according to business. Person(s) or department(s) responsible: Storm water manager. Timeframe/milestones for implementation: Annual distribution.
BMP PE5. Insert BMP description: Storm water Educational material. Measurable Goal: Distribute pamphlets at May Madness, North Louisiana Cotton Festival and at council meetings. Person(s) or department(s) responsible: Storm water manager. Timeframe/milestones for implementation: March, May, September and October each year.
BMP PE6. Insert BMP description: Using the media to get the message out. Measurable Goal: Ads posted on local cable channel. Person(s) or department(s) responsible: Storm water manager. Timeframe/milestones for implementation: Different ad showed monthly.
Others (add text as needed):
Minimum Control Measure 2. Public Involvement and Participation in Development and Implementation of Storm Water Program
List measurable goals with start and end dates, interim milestones, and frequency (add text as needed):

BMP PI1. Insert BMP description: Community Cleanups. Measurable Goal: Assist Keep Morehouse Beautiful with the annual Community cleanup. Person(s) or department(s) responsible: Storm water manager. Timeframe/milestones for implementation: October of each year.
BMP PI2. Insert BMP description: Storm Drain Stenciling. Measurable Goal: Place 20 storm drain stickers annually. Person(s) or department(s) responsible: Storm water manager. Timeframe/milestones for implementation: Annually place 20 storm drain stickers.
BMP PI3. Insert BMP description: Citizen Complaint Hotline. Measurable Goal: Educational material added to public TV and updated annually with a change every month. Person(s) or department(s) responsible: Storm water manager. Timeframe/milestones for implementation: Annually place updated ads to public TV.
Others (add text as needed): Click here to enter text.
<u>Minimum Control Measure 3.</u> Illicit Discharge Detection and Elimination
List measurable goals with start and end dates, interim milestones, frequency, and maintenance activities with schedules (add text as needed):
BMP IDDE1. Insert BMP description: Citizens Complaint hotline. Measurable Goal: Monthly ad placed in newspaper, public cable and on web site. Person(s) or department(s) responsible: BMP PI2. Insert BMP description: Storm Drain Stenciling. Measurable Goal: Place 20 storm drain stickers annually. Person(s) or department(s) responsible: Storm water manager. Timeframe/milestones for implementation: Annually place 20 storm drain stickers.. Timeframe/milestones for implementation: Monthly ad placed in newspaper and cable. Permanently placed on web site. BMP maintenance activities and schedule: Renew ads monthly.
BMP IDDE2. Insert BMP description: Illegal Dumping/illicit discharge hotline. Measurable Goal: Monthly ad placed in newspaper, public cable TV and on website. Person(s) or department(s) responsible: Storm water manager. Timeframe/milestones for implementation: Monthly ad placed in newspaper and cable TV. Permanently placed on website. BMP maintenance activities and schedule: Renew ads monthly.
BMP IDDE3. Insert BMP description: Sanitary Sewer overflows. Measurable Goal: Report sewer overflows to LDEQ, Continue smoke testing to find problem areas. Person(s) or department(s) responsible: City of Bastrop Sewer Department. Timeframe/milestones for implementation: Quarterly smoke test area to find leaks and repair. BMP maintenance activities and schedule: Quarterly take section of problem areas define by pump station runtime and smoke test area. Areas where sink holes are found are dye tested or smoke tested, if problem is found area is repaired.

BMP IDDE3. Insert BMP description: TMDL- Fecal Coliform. Measurable Goal: Repair overflows, bypasses and disinfect areas affected. Person(s) or department(s) responsible: City of Bastrop Sewer Department. Timeframe/milestones for implementation: Ongoing repairs and disinfection, with smoke testing and dye testing as needed. Studies are being performed and grant approved to eliminate bypass pipe, which will be capped as soon as job is complete which should be by Dec. 2019. BMP maintenance activities and schedule: Ongoing disinfection in basket at bypass pipe, with disinfection and repairs made as needed.
Others (add text as needed): Click here to enter text.
<u>Minimum Control Measure 4.</u> Construction Site Storm Water Runoff Control
List measurable goals with start and end dates, interim milestones, frequency, and maintenance activities with schedules (add text as needed):
BMP CONS1. Insert BMP description: BMP Inspection and maintenance. Measurable Goal: Inspection construction sites for fencing, entrance stabilization, ditch berms. Person(s) or department(s) responsible: Storm water manager. Timeframe/milestones for implementation: Construction sites are checked monthly and after rain event of .25 inches. within the first 30 minutes of a rain event. BMP maintenance activities and schedule: Inspection of sites monthly and after each rain event.
BMP CONS2. Insert BMP description: Construction entrance stabilization to prevent vehicle tracking. Measurable Goal: Minimization of the tracking of sediments off sites by vehicles. Person(s) or department(s) responsible: Storm water manager. Timeframe/milestones for implementation Construction sites are checked monthly and after rain event of .25 inches. within the first 30 minutes of a rain event. BMP maintenance activities and schedule: Inspection of sites monthly and after each rain event.
BMP CONS3. Insert BMP description: Construction site inspection by municipal inspectors. Measurable Goal: Inspection of sites monthly and after each rain event. Person(s) or department(s) responsible: Storm water manager. Timeframe/milestones for implementation: Construction sites are checked monthly and after rain event of .25 inches. within the first 30 minutes of a rain event. BMP maintenance activities and schedule: Inspection of sites monthly and after each rain event.
BMP CONS4. Insert BMP description: Silt Fence perimeter control. Measurable Goal: Inspection of sites monthly and after each rain event. Person(s) or department(s) responsible: Storm water manager. Timeframe/milestones for implementation Construction sites are checked monthly and after rain event of .25 inches. Within the first 30 minutes of a rain event. BMP maintenance activities and schedule: Inspection of sites monthly and after each rain event.
BMP CONS5. Insert BMP description: Education and training measures for construction site operators. Measurable Goal: Educate contractor and public with construction ordinance during application process. Person(s) or department(s) responsible: Storm water manager. Timeframe/milestones for implementation Educational will be an ongoing process as needed per construction. BMP maintenance activities and schedule: Annually update the methods to educate construction operators and general public.

Others (add text as needed): Click here to enter text.
<u>Minimum Control Measure 5.</u> Post-construction Storm Water Management in New Development and Redevelopment
List measurable goals with start and end dates, interim milestones, frequency, and maintenance activities with schedules (add text as needed):
BMP POST1. Insert BMP description: Catch Basins. Measurable Goal: Sediment controls shall be provided in the form of settling basins or sediment traps or tanks and perimeter controls. Person(s) or department(s) responsible: Storm water manager. Timeframe/milestones for implementation: At end when construction job is complete and annually thereafter. Jan. through April, beginning Jan 2019. BMP maintenance activities and schedule: Annually check catch basins for integrity.
BMP POST2. Insert BMP description: Ordinance for post construction. Measurable Goal: Check ordinance in place to EPA requirements and upgrade as necessary. Person(s) or department(s) responsible: Storm water manager. Timeframe/milestones for implementation: Within 3 months of new permit and annually thereafter. Beginning Jan 2019. BMP maintenance activities and schedule: Check ordinance to meet EPA requirements within 3 months of new permit and annually beginning Jan 2019.
BMP POST3. Insert BMP description: BMP Maintenance and Inspection. Measurable Goal: Inspect BMP’s at 100% of post construction sites. Person(s) or department(s) responsible: Storm water manager. Timeframe/milestones for implementation: Ongoing from time of construction starts and annually after first year of post construction. BMP maintenance activities and schedule: Monthly inspection and after rain events of .25 inches and annually after the first year of post construction.
Others (add text as needed): Click here to enter text.
<u>Minimum Control Measure 6.</u> Pollution Prevention/Good Housekeeping for Municipal Operations
List measurable goals with start and end dates, interim milestones, frequency, and maintenance activities with schedules (add text as needed):
BMP PP1. Insert BMP description: Animal carcass collection from roadway Measurable Goal: Pickup animal carcasses in road and dispose in city landfill. Person(s) or department(s) responsible: Street Department/Animal Control for City of Bastrop. Timeframe/milestones for implementation: Picked up on daily basis as needed. Control was in place in 2006 and will be continued. BMP maintenance activities and schedule: Carcasses are picked up daily and disposed.

BMP PP2. Insert BMP description: Hazardous Materials Storage Measurable Goal: Hazardous Materials are stored on spill containment pallets. Person(s) or department(s) responsible: Storm water manager Timeframe/milestones for implementation: With each new shipment of hazardous materials, materials must be stored on spill containment pallets. Beginning Jan. 2009 and continuing. BMP maintenance activities and schedule: Containment pallets are checked monthly.
BMP PP3. Insert BMP description: Illegal dumping control. Measurable Goal: Notify public it is illegal dumps into the storm drains or sewer system. Person(s) or department(s) responsible: Storm water manager. Timeframe/milestones for implementation: Ad is placed in daily newspaper on first Wednesday of each monthly. Ad is placed on Suddenlink cable community ad site, and runs daily. Permanent notice is posted on City of Bastrop web page of who to call if they see illegal dumping. Beginning Jan. 2009 and continuing. BMP maintenance activities and schedule: Annually have ads posted into newspaper and public cable tv at the beginning of Jan. 2009 and continuing.
BMP PP4. Insert BMP description: Parking Lot and Street cleaning. Measurable Goal: Street sweeper cleans roads throughout the city. Person(s) or department(s) responsible: Street Department for the City of Bastrop. Timeframe/milestones for implementation: Daily cleaning of streets beginning Jan. 2009 and continuing. BMP maintenance activities and schedule: Daily cleaning of all streets with proper disposal- Monday through Friday, except holidays.
BMP PP5. Insert BMP description: Spill Response and prevention plans for Municipal facilities. Measurable Goal: Spill prevention and proper notification in the event of a spill. Person(s) or department(s) responsible: Storm water manager. Timeframe/milestones for implementation: Plans are in place at this time. Spill containment and socks are available and at locations of possible chemical spills, and overflows. BMP maintenance activities and schedule: Spill containers are checked monthly and any sewer overflows are documented at the time of overflow and reported to LDEQ for major overflows, and for minor overflows notifications are sent in monthly.
BMP PP6. Insert BMP description: Used oil recycling. Measurable Goal: Used oil is collected by operator at the time of oil change, carried to the City of Bastrop garage and poured into 55 gallon drums for recycling by the City of Bastrop. Person(s) or department(s) responsible: City of Bastrop Sewer Department. Timeframe/milestones for implementation: Plans are in place at this time. All used oil is carried to the City of Bastrop garage immediately after collection for proper recycling. This began Jan. 2009 and continuing. BMP maintenance activities and schedule: After each oil change, used oil is disposed properly at City of Bastrop garage.
BMP PP7. Insert BMP description: Vehicle washing. Measurable Goal: To prevent wash water from discharging into storm drains, vehicles are washed over drains which goes into the sewer. Person(s) or department(s) responsible: City of Bastrop Sewer. Timeframe/milestones for implementation: This is currently in place. Beginning Jan 2009 and continuing. BMP maintenance activities and schedule: Any washing of vehicle and other items are washed over sewer drains at all times.
BMP PP8. Insert BMP description: Operation and Maintenance program to reduce preventing or reducing pollutant runoff from municipal operations. Measurable Goal: To prevent sewer, chemicals and other contaminants from reaching storm waters. Person(s) or department(s) responsible: City of Bastrop Sewer. Timeframe/milestones for implementation: Current plan is in place, beginning Jan 20019 and still continuing. BMP maintenance activities and schedule: Spill socks, spill containment and absorbent pads are used during each job.

BMP PP9. Insert BMP description: Dredged spoil, sediments, debris, and floatables.
Measurable Goal: 100% of spoils, sediments, debris into landfill, and 100% of floatables go into dumpsters.
Person(s) or department(s) responsible: City of Bastrop Street Department/Sewer Department
Timeframe/milestones for implementation: Ongoing disposal of 100% of spoils, sediment and debris into city landfill. 100% of floatables are disposed into dumpsters.
BMP maintenance activities and schedule: Ongoing removal of debris and floatables from storm drains and placed into dumpsters or landfill.

SECTION VI.A – IMPAIRED WATERBODIES AND TMDL INFORMATION (Permit Part III)

1. Does any subsegment within your MS4 boundaries fall under the most recent Integrated Report classification of 4a or 5 (see list at http://deq.louisiana.gov/page/water-quality-integrated-report-305b303d)?
Yes XX☐ No ☐

2. If any of your MS4 subsegments are classified as Integrated Report Category 4a (*Impaired but TMDL Completed*) or 5 (*Impaired and requires a TMDL*) and if the Suspected Sources of Impairment (see Appendix A of the most recent Integrated Report) are municipal in origin (for example, *Sanitary Sewer Overflows*, *Discharges from Municipal Separate Storm Sewer Systems*, *Forced Drainage Pumping*, *Municipal (Urbanized High Density Area)*, *Urban Runoff/Storm Sewers*, and *Residential Districts*) you must document in your SWMP how the BMPs and other controls implemented will control the discharge of these pollutants (see Permit Part III.B; you may add text as needed).

2.a. MS4 Suspected Source of Impairment from Appendix A of Integrated Report:
Subsegment LA080401_00; **BMP name and function:** Sanitary Sewer Overflows.
Subsegment ; **BMP name and function:** Click here to enter text.
Subsegment ; **BMP name and function:** Click here to enter text.

3. Has a TMDL been approved for any subsegment(s) in your MS4 (Integrated Report Cat. 4a)? Yes XX☐ No ☐
If Yes, you must list any TMDL requirements (see 3.a below) in the SWMP that are applicable to MS4 discharges into the subsegments where TMDLs have been established (see Permit Parts III.B and IV.H 1-6; you may add text as needed). If there are none, please check this box: ☐

3. A.
Subsegment LA080401_00; **TMDL requirements:** Reporting overflows to LDEQ, continuation of smoke and dye testing to eliminate infiltration of sewer system by rain water.
Subsegment LA080401_00; **TMDL requirements:** Reduction of fecal coliform due to overflows.
Subsegment ; **TMDL requirements:** Click here to enter text.

SECTION VII – TOPOGRAPHIC MAP

Attach to this NOI a USGS 7.5 minute (1:24,000 scale) topographic map, or equivalent, of the MS4 service area with the known municipal storm sewer outfalls and any major control structures (retention or detention basins, infiltration devices, etc.) identified. Include on the map the area extending at least one mile beyond your service boundaries. The map must be attached to BOTH NOIs that are submitted to LDEQ (i.e., the original NOI and the copy of the NOI). Waterways and streets/highways must be clearly identified by name on the map. Appropriate maps can be obtained from local government agencies such as DOTD or the Office of Public Works. Maps can also be obtained online at http://map.deq.state.la.us/ or www.topozone.com. Private map companies can also supply you with these maps. If you cannot locate a map through these sources you can contact the Louisiana Department of Transportation and Development at:

1201 Capitol Access Road
Baton Rouge, LA 70802
(225) 379-1107
maps@dotd.louisiana.gov

Alternatively, permit applicants may submit a CD containing the appropriate GIS layers, created using ESRI software, such as ArcMap.

SECTION VIII – DISCHARGE CHARACTERIZATION

Attach any existing quantitative data that characterizes the discharge. Depending upon availability, you should include:

1. Monthly mean rainfall estimates;

2. Measured or estimated volume of the discharges from the municipal storm sewer per inches of rain;

3. Quantitative data describing the quality of discharges from the municipal storm sewer, including the outfalls sampled, sampling procedures and analytical methods used; and

4. The results of any visual or analytical field screening at identified outfalls, including wet and dry weather screenings.

SECTION IX - SIGNATURE

According to the Louisiana Water Quality Regulations, LAC 33:IX.2503, the following requirements shall apply to the signatory page in this application:

Chapter 25. Permit Application and Special LPDES Program Requirements

2503. Signatories to permit applications and reports

A. All permit applications shall be signed as follows:

1. For a corporation - by a responsible corporate officer. For the purpose of this Section responsible corporate officer means:

   (a) A president, secretary, treasurer, or vice-president of the corporation in charge of a principal business function, or any other person who performs similar policy- or decision-making functions for the corporation, or

   (b) The manager of one or more manufacturing, production, or operating facilities provided: the manager is authorized to make management decisions that govern the operation of the regulated facility, including having the explicit or implicit duty of making major capital investment recommendations and initiating and directing other comprehensive measures to ensure long term environmental compliance with environmental laws and regulations; the manager can ensure that the necessary systems are established or actions taken together complete and accurate information for permit application requirements; and the authority to sign documents has been assigned or delegated to the manager in accordance with corporation procedures.

NOTE: LDEQ does not require specific assignments or delegations of authority to responsible corporate officers identified in the Permit **Standard Conditions, Section D.10.a.(1)(a)**. The agency will presume that these responsible corporate officers have the requisite authority to sign permit applications unless the corporation has notified the state administrative authority to the contrary. Corporate procedures governing authority to sign permit applications may provide for assignment or delegation to applicable corporate positions under Permit **Standard Conditions, Section D.10.a.(1)(b)** rather than to specific individuals.

2. For a partnership or sole proprietorship - by a general partner or the proprietor, respectively; or

3. For a municipality, state, federal or other public agency – by either a principal executive officer or ranking elected official. For the purposes of this section a principal executive officer of a federal agency includes:

   (a) The chief executive officer of the agency, or

   (b) A senior executive officer having responsibility for the overall operations of a principal geographic unit of the agency (e.g., Regional Administrators of EPA).

B. All reports required by permits and other information requested by the state administrative authority shall be signed by a person described in Permit **Standard Conditions, Section D.10.a**., or by a duly authorized representative of that person. A person is a duly authorized representative only if:

1. The authorization is made in writing by a person described in Permit **Standard Conditions, Section D.10.a**.

2. The authorization specifies either an individual or a position having responsibility for the overall operation of the regulated facility or activity such as the position of plant manager, operator of a well or well field, superintendent, position of equivalent responsibility, or an individual or position having overall responsibility for environmental matters for the company, (a duly authorized representative may thus be either a named individual or any individual occupying a named position); and

3. The written authorization is submitted to the state administrative authority.

C. Changes to authorization. If an authorization under Permit **Standard Conditions, Section D.10.b** is no longer accurate because a different individual or position has responsibility for the overall operation of the facility, a new authorization satisfying the requirements of **Section D.10.b** must be submitted to the state administrative authority prior to or together with any reports, information, or applications to be signed by an authorized representative.

D. Any person signing any document under Permit **Standard Conditions, Section D.10.a. or b** shall make the following certification:

"I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information including the possibility of fine and imprisonment for knowing violations."

Signatory Requirements

All storm water management plans, storm water pollution prevention plans, reports, certifications, or information either submitted to the state administrative authority or that this permit requires be maintained by the permittee, shall be signed by a person described in LAC 33:IX.2503.A, or by a duly authorized representative of that person. A person is a duly authorized representative only if:

1. The authorization is made in writing by a person described in LAC 33:IX.2503.A.3,

2. The authorization specifies either a principal executive officer or ranking elected official. (A duly authorized representative may thus be a named individual or any individual occupying a named position), and

3. The written authorization is submitted to the state administrative authority.

Pursuant to the Water Quality Regulations (specifically LAC 33:IX.2503) promulgated September 1995, the state NOI must be signed by a responsible individual as described in LAC 33:IX.2503 and that person shall make the following certification:

"I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information including the possibility of fine and imprisonment for knowing violations."

Signature ______________________________

Printed Name ______________________________

Title ______________________________

City/Town ______________________________

Date ______________________________

Telephone ______________________________

<u>CHECKLIST</u>

To prevent any unnecessary delay in the processing of your notice of intent to be covered under the general permit, please take a moment and check to be certain that the following items have been addressed and enclosed:

1. <u>ALL</u> questions and requested information have been answered (N/A if the question or information was not applicable).
2. The <u>appropriate</u> person has signed the signatory page.
3. Please forward the original and one copy of this NOI and all attachments.

<u>ANY NOI THAT DOES NOT CONTAIN ALL OF THE REQUESTED INFORMATION WILL BE CONSIDERED INCOMPLETE. NOI PROCESSING WILL NOT PROCEED UNTIL ALL REQUESTED INFORMATION HAS BEEN SUBMITTED</u>.

NOTE: UPON RECEIPT AND SUBSEQUENT REVIEW OF THE NOI BY THE WATER PERMITS DIVISION, YOU MAY BE REQUESTED TO FURNISH ADDITIONAL INFORMATION IN ORDER TO COMPLETE THE PROCESSING OF THE NOI.